FEBRUARY 1941—FORTY-SEVENTH YEAR

MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

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A certain New Jersey manufacturer reports this very good saving in tapping costs. This screw machine is turning out a part made of 3½% nickel steel. Tapping a ⅜-24 hole was the "bottleneck" of the job until they switched to "G. T. D. Greenfield" Taps. The solution recommended was a roughing cut with a "*Gun*" Tap and the last .010 of an inch removed by a ⅜-24 High Speed Steel Ground Thread "G. T. D. Greenfield" Tap. Production on the whole job jumped 50%.

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MACHINERY

FEBRUARY, 1941

March MACHINERY will continue to present information of importance from the point of view of the Defense Program. The leading article will describe the methods used in producing shells for anti-aircraft guns. There will also be articles on building flying boats in a large aircraft plant, and on methods and equipment used to speed up the production of airplane engines. For those not directly interested in munitions, there will be a variety of other material, including an article describing operations in building oil-well equipment that will drill 15,000 feet deep, and the regular departments covering Ingenious Mechanisms, the Design of Tools and Fixtures, etc.

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Number 6

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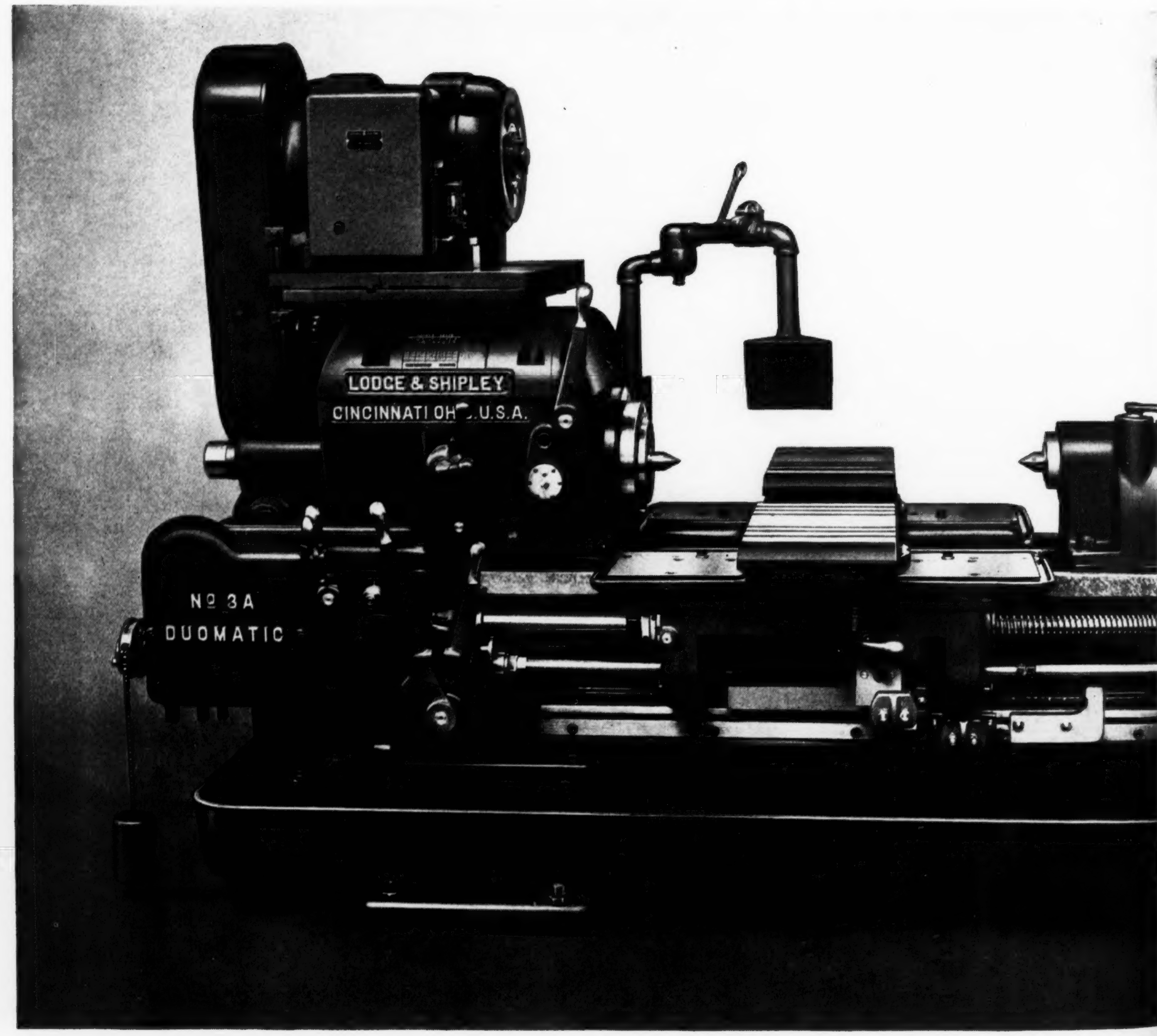

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MACHINERY

Volume 47 NEW YORK, FEBRUARY, 1941 Number 6

Machine Shop Behind the Scenes in a Motion Picture Studio

Fine Workmanship is Necessary in Building and Maintaining the Large Amount of Precision Mechanical Equipment Used in M-G-M Studios

By CHARLES O. HERB

MOTION picture production involves a great deal more than the talented performance of charming actresses and handsome leading men. Behind the scenes in the motion picture studios are busy laboratories and shops for printing, developing, and drying millions of feet of film weekly; for performing the many tasks necessary to insure maximum pictorial value of the duplicate films made from the masters; for combining the original pictures and the sound films; for cleaning and polishing the films; and so on. Back of all these activities, in turn, is the machine shop in which the various machines and optical equipment are maintained, and special mechanical devices made.

Under normal conditions, the film laboratory of Metro-Goldwyn-Mayer Pictures, Culver City, Calif.,

turns out over 3,000,000 feet of film per week. Twenty-two printing machines of intricate design are used to duplicate films from masters, the general rule being to make about 350 copies from each master. There are eighteen developing machines which carry the film up and down over rolls 6 feet 4 inches apart, submerged in developer tanks. These machines run continuously, and about 250 feet of film are in the developer all the time.

At the far end of the tank, the film is fed into a drying cabinet, which also has two sets of rolls 20 feet in length, about 7 feet apart, that are enclosed in a vertical glass-front oven. The film passes up and down over these rolls 96 times before it leaves the cabinet. It takes about 25 minutes for any portion of a film to move the length of a developer tank and the adjacent drying cabinet.

In the basement beneath the developing room is a department containing eighteen vats, 6 feet in diameter by 4 feet high, in which developer is constantly being circulated to control the temperature. As the temperature of this developer must not vary more than a minute amount throughout the day, air-conditioning equipment has been installed to control the humidity and temperature throughout the laboratory.

The laboratory also contains a considerable number of film waxing, polishing, and measuring machines. All together, there are about 300 electric motors in the laboratory, ranging in capacity from 1/50 to 300 H.P. In supplying electricity to the printing machines, it is necessary to control the voltage within one-fourth of a volt.

All this equipment, as well as other laboratory machinery and devices, and a considerable number of cameras and projection machines, sound-recording equipment, lighting apparatus, etc., must be maintained in good working order. The precision machine shop established for the purpose employs twenty-eight expert machinists and instrument makers, as well as several electricians. Some of the precision machines that are required in the production of motion pictures are not only kept in repair in this machine shop, but are also built completely there.

A general view of the machine shop is shown in Fig. 1. The basic equipment consists of four bench lathes, four medium-size engine lathes, three milling machines, five drilling machines, and two grinding machines. The high quality of workmanship required in a machine shop of the motion picture industry will be realized from the following description of typical operations performed in this shop.

The application of a Hendey engine lathe for cutting a thread on a camera lens mount is shown in Fig. 2. This part, which has an inside diameter of 2.0625 inches, is machined from duralumin, and is held on a mandrel for the operation. The thread is of square form, 2.375 inches outside diameter, and has two and one-half threads per inch. It must be accurate as to outside diameter within limits of plus 0.0002 inch minus 0.0002 inch, and the pitch must be maintained within the same tolerance.

Many small holes are drilled in making parts for the equipment of a motion picture studio, and holes as small as 0.035 inch are tapped with threads

Fig. 1. Shop that Maintains in Working Order the Large Amount of Mechanical and Optical Equipment Required by the M-G-M Motion Picture Studios

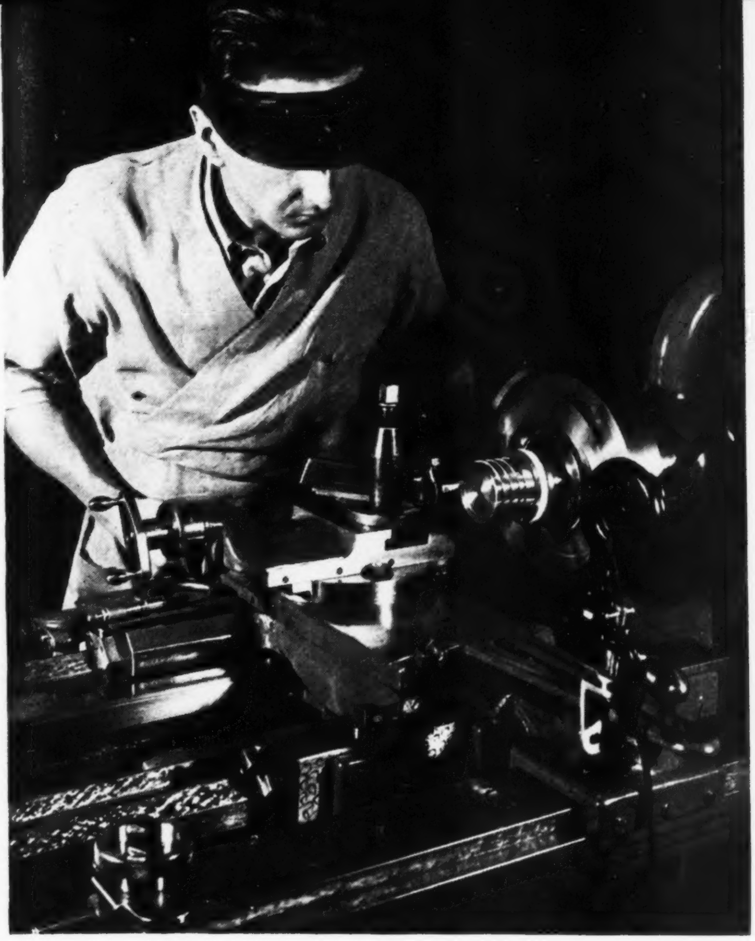


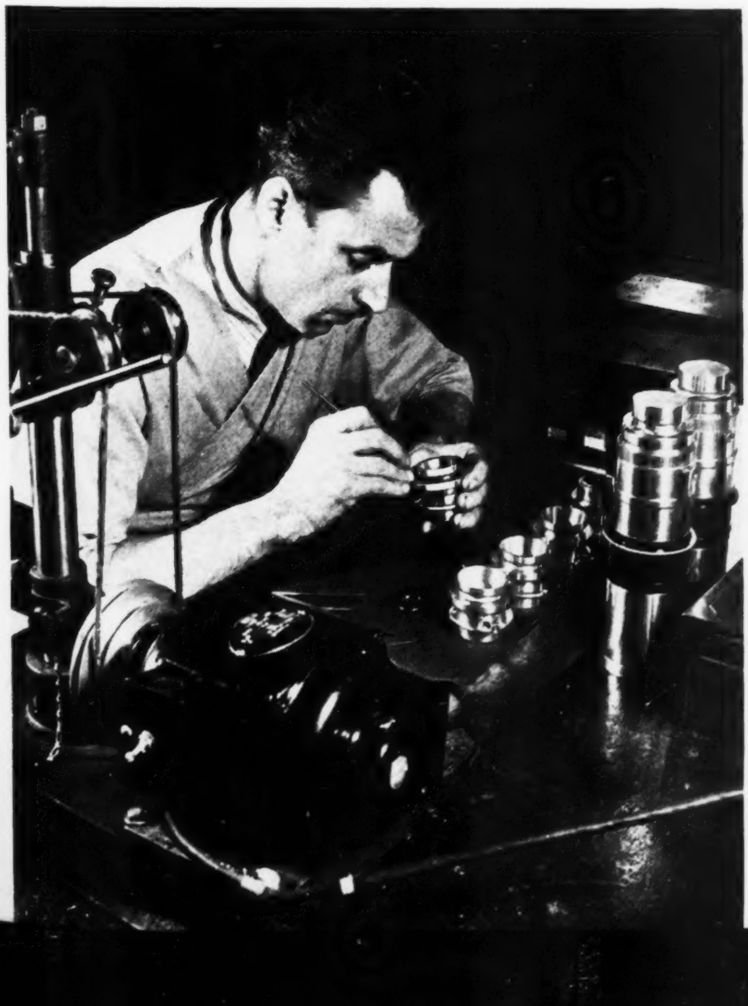
Fig. 2. Cutting an External Thread of Square Form on a Camera Lens Mount

Fig. 3. Drilling Very Small Holes in Pieces for Motion Picture Equipment

as fine as 120 per inch. In Fig. 3 is shown a typical operation—the drilling of a series of holes through the flange of a camera lens mount — being performed on a Muehlmatt high-speed sensitive drilling machine. Lens mounts are made completely in the studio machine shop, and are assembled there, the lenses being purchased from optical concerns. A view of the bench where the lens mounts are assembled is shown in Fig. 4. Two completely assembled lenses are seen at the right.

Fig. 4. Bench at which Lens Mounts for Motion Picture Cameras are Assembled

Fig. 5. Milling a Dovetail on a Camera Base with an Adjustable Cutter-head



A part for the movement of a motion picture camera is being finished on the Brown & Sharpe surface grinding machine shown in Fig. 6, which is equipped with a chuck of the permanent magnet type. The edge being ground must be accurate with respect to the base of the part, both for distance and parallelism, within 0.0005 inch. This part is made from steel.

A cam for a motion picture camera is shown being ground in Fig. 9 on a Hardinge bench lathe equipped with a grinding attachment on the compound rest. The cam is of a modified heart shape, requiring a horizontal movement of the work relative to the grinding wheel in order to grind the cam contour. This horizontal movement is derived from a master cam attached to a faceplate mounted on the lathe spindle. The work itself is attached to a fixture on the front end of a mandrel that extends through the hollow spindle. This fixture is moved sidewise as the master cam revolves, due to the action of a follower on the fixture that engages the master cam on the faceplate. Thus it will be seen that the center-to-center distance between the work and the grinding wheel spindle is changed automatically to suit the contour of the cam as the latter is revolved.

A Brown & Sharpe horizontal milling machine equipped with a universal milling attachment is shown in Fig. 7 set up for an operation on a motion picture projector. The operation consists of milling the inside surfaces of two lugs with an end-mill that is positioned at an angle of 10 degrees.

Two rows of thirty-two teeth each were cut around a sprocket for a motion picture camera by employing a milling machine set up as shown in Fig. 8. The work was supported at one end by a dividing head which enabled it to be accurately indexed from tooth to tooth, and the opposite end was held on a regular tailstock. The tooth-cutting was done by a fly cutter mounted on the spindle of the machine.

One tooth space was cut in each row of the teeth with a single feeding movement of the table past the fly cutter. In other words, both rows of teeth were finished at one complete indexing of the sprocket. This method insured close alignment of all teeth in the two rows.

Fig. 5 shows a dovetail being milled across an arm of a motion picture camera base on a Van Norman milling machine. This machine is applicable to a large variety of work that passes through the shop, because of the fact that the cutter-head can be adjusted from the horizontal to the vertical for milling to various angles, and because the ram on which the cutter-head is mounted can be adjusted in and out horizontally on the top of the column.

The accurate boring of a hole in a gear-box casting for a pan and tilt-head velocitator is illustrated in Fig. 10. The machine is a Hardinge high-speed tool-room lathe. One end of the casting is mounted on a short mandrel that is held in the collet chuck of the headstock. The bearing must be bored to the specified diameter within plus 0.0002 inch minus

Fig. 6. Surface Grinding Operation on a Part for the Movement of a Motion Picture Camera

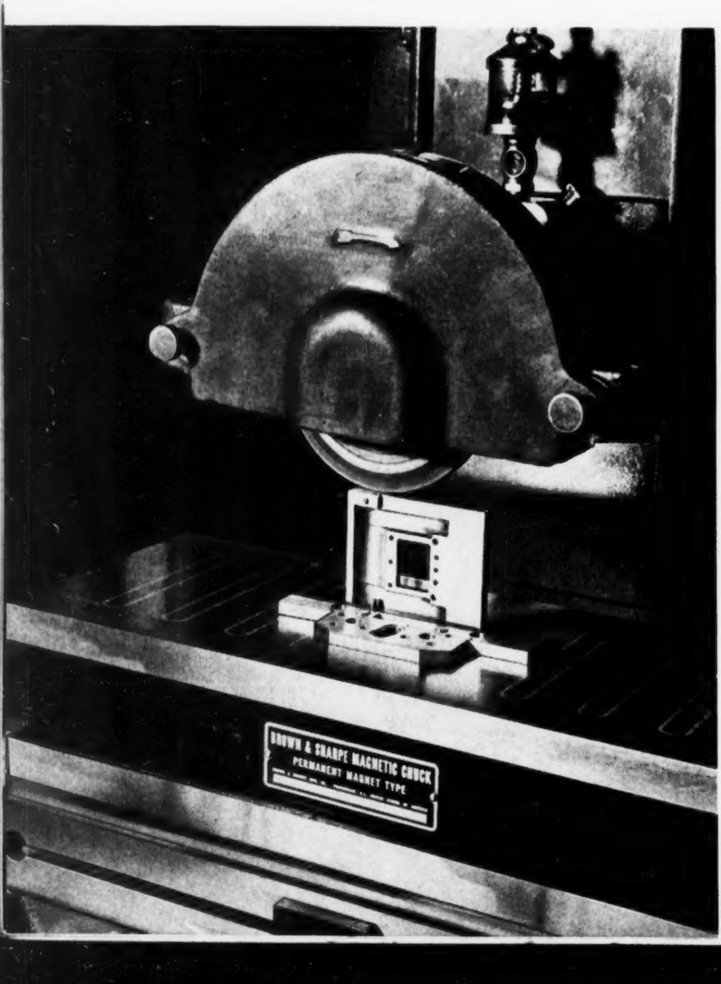
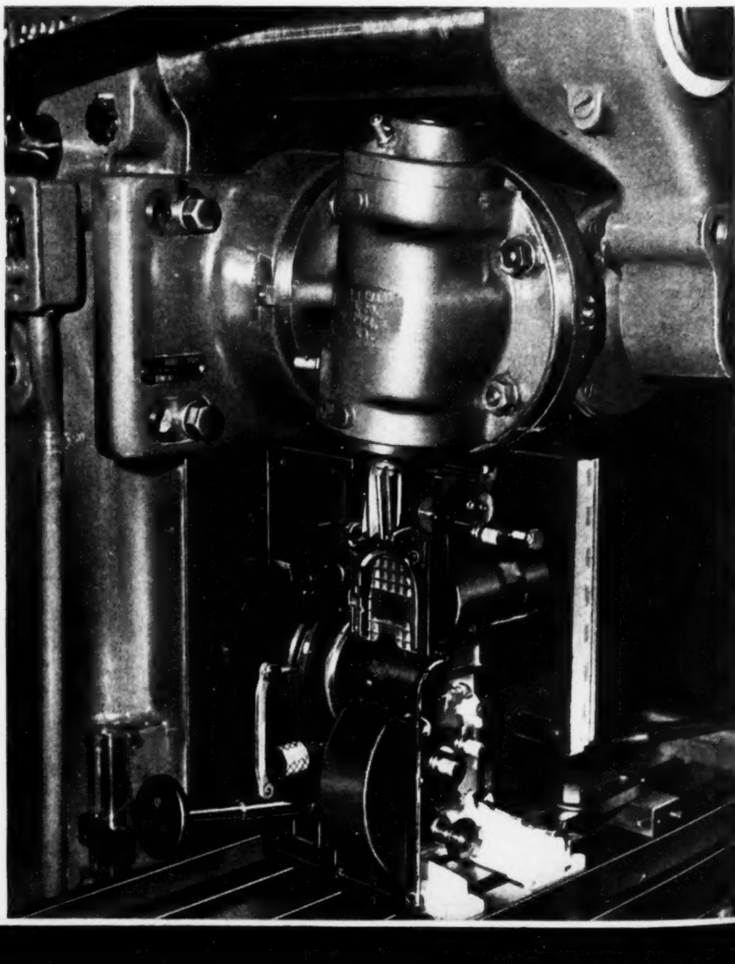


Fig. 7. Typical Operation Performed on a Milling Machine Equipped with a Universal Cutter-head



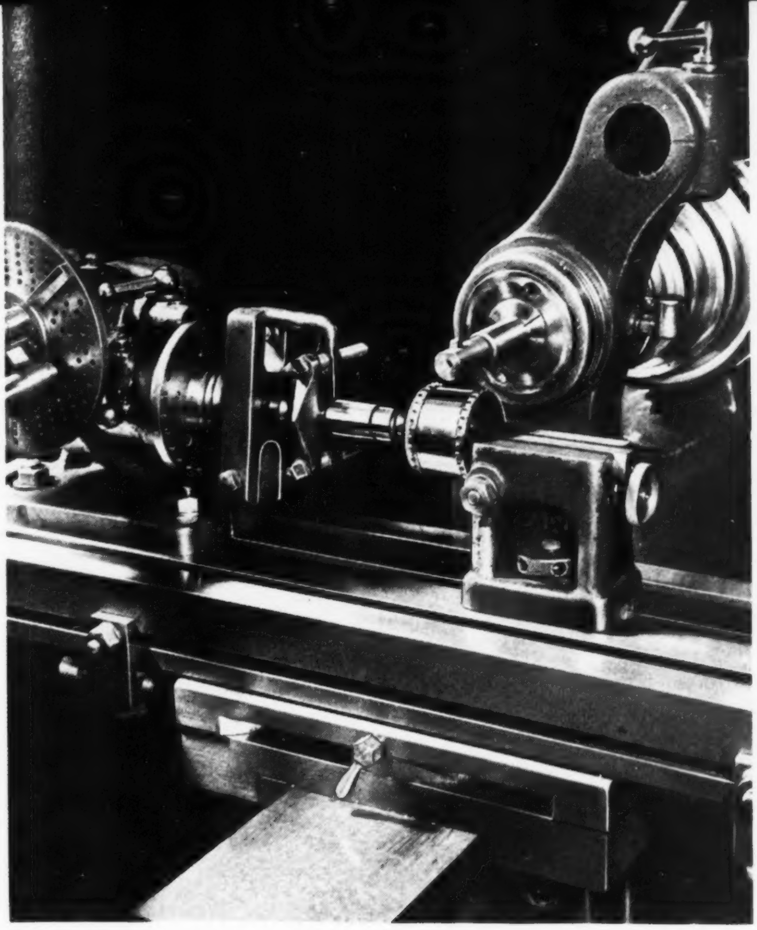


Fig. 8. Milling Two Rows of Thirty-two Teeth Each around a Camera Sprocket

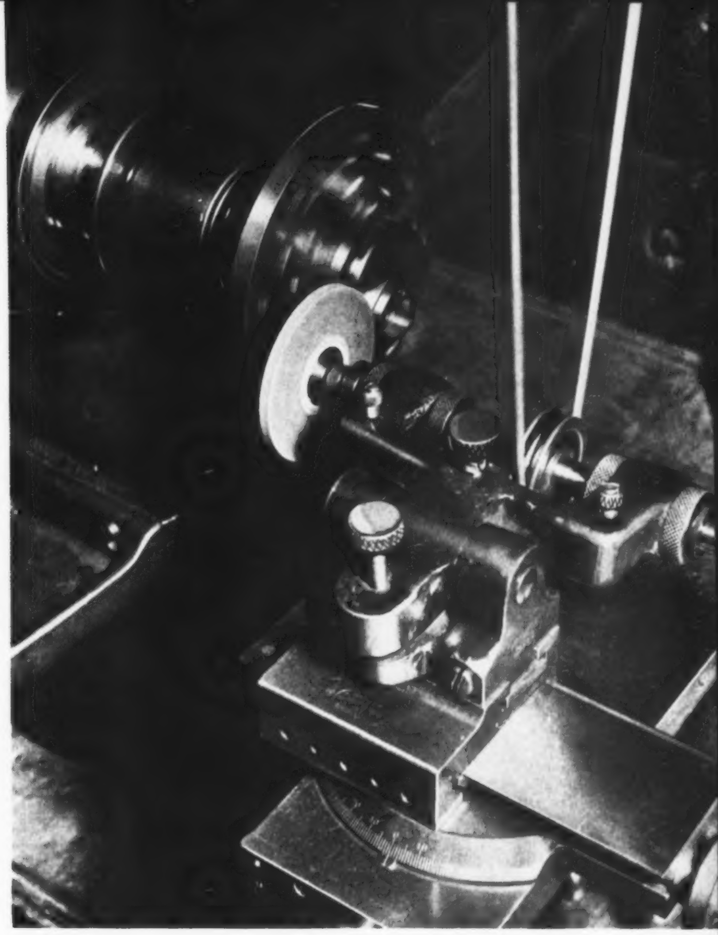


Fig. 9. Ingenious Set-up Employed for Grinding the Contour of a Camera Cam

nothing, and must be in true alignment with the opposite bearing on which the casting is being held. The part is a bronze casting.

The intricacy of some of the mechanisms made in this shop necessitates the use of microscopes for assembling and inspecting purposes. The microscope seen in Fig. 11 was especially adapted for checking the light valves of sound-recording machines. These valves employ steel ribbons that are only 0.004 inch thick.

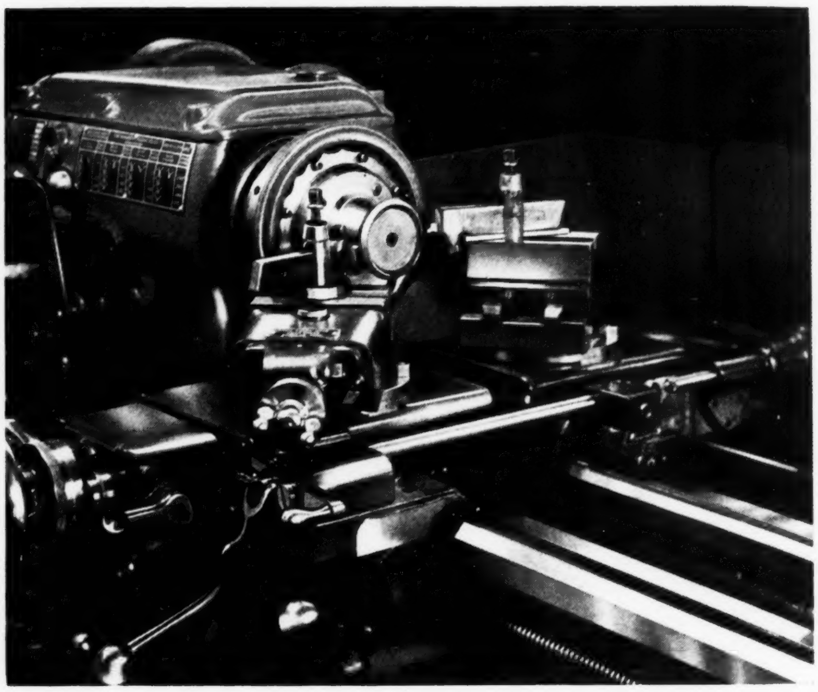
Fig. 10. Precision Bench Lathe Used for Accurately Boring a Hole in a Gear-box

Fig. 11. A Microscope is Required for Assembling and Inspecting Intricate Parts

Operations on Airplane Engine Parts at the Pratt & Whitney Plant

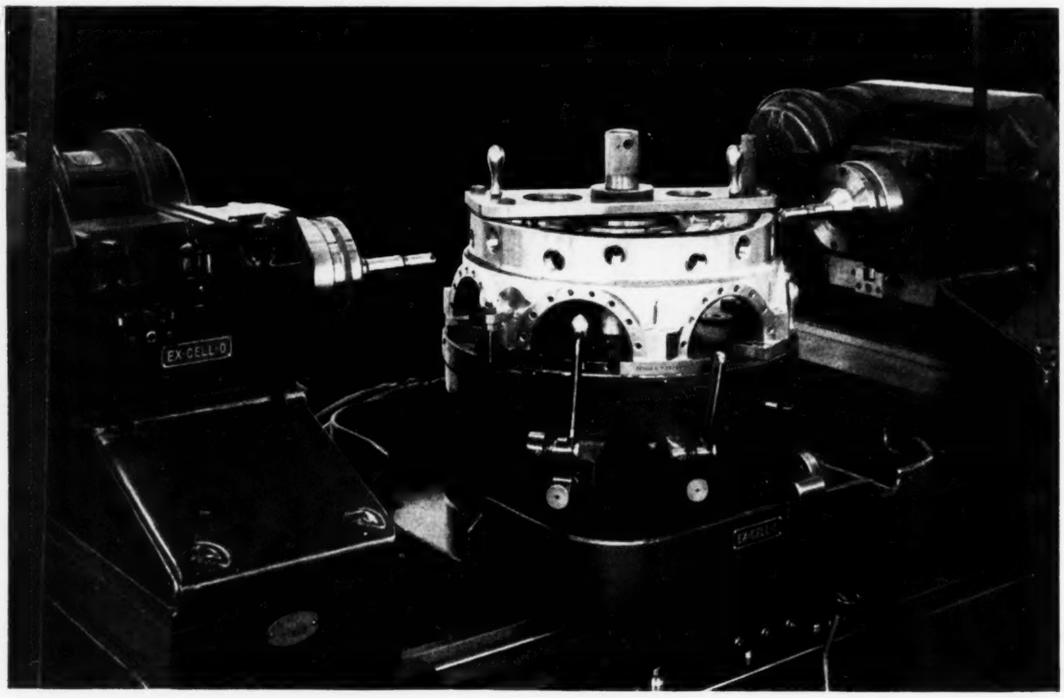
THE Ex-Cell-O double-end precision boring machine shown below is employed by the Pratt & Whitney Aircraft Division of the United Aircraft Corporation, East Hartford, Conn., for accurately finishing twenty-eight valve tappet holes around main crankcase halves. The holes are semi-finish-bored to two diameters by the cutter-spindle on the head at the left, and then finished to diameters between 1.1245 and 1.1255 inches, and 1.1295 and 1.1305 inches by the tool-spindle on the right-hand head. The semi-finish boring-bar has two cutters, and the finish-bar three cutters.

The fixture is indexed around a circle and is raised and lowered to bring the various tappet holes successively into line with the cutter-spindles. Movement of the work-table to and from the cutter-heads is effected hydraulically, as is standard practice on these machines.



Lathe in which the Angular Face and Edge Surfaces of Small Bevel Gears are Automatically Machined to the Required Accuracy

In the same factory, small bevel gears are simultaneously turned on the angular face and edge surfaces, as shown in the illustration above. This operation is performed on a Monarch engine lathe. The cuts are taken by tools mounted at the front and rear of the carriage, which are fed by power across the gear surfaces at the required angles after the carriage has been fed longitudinally to a stop.



Semi-finish- and Finish-boring Twenty-eight Valve Tappet Holes around the Main Crankcase Halves of Airplane Engines

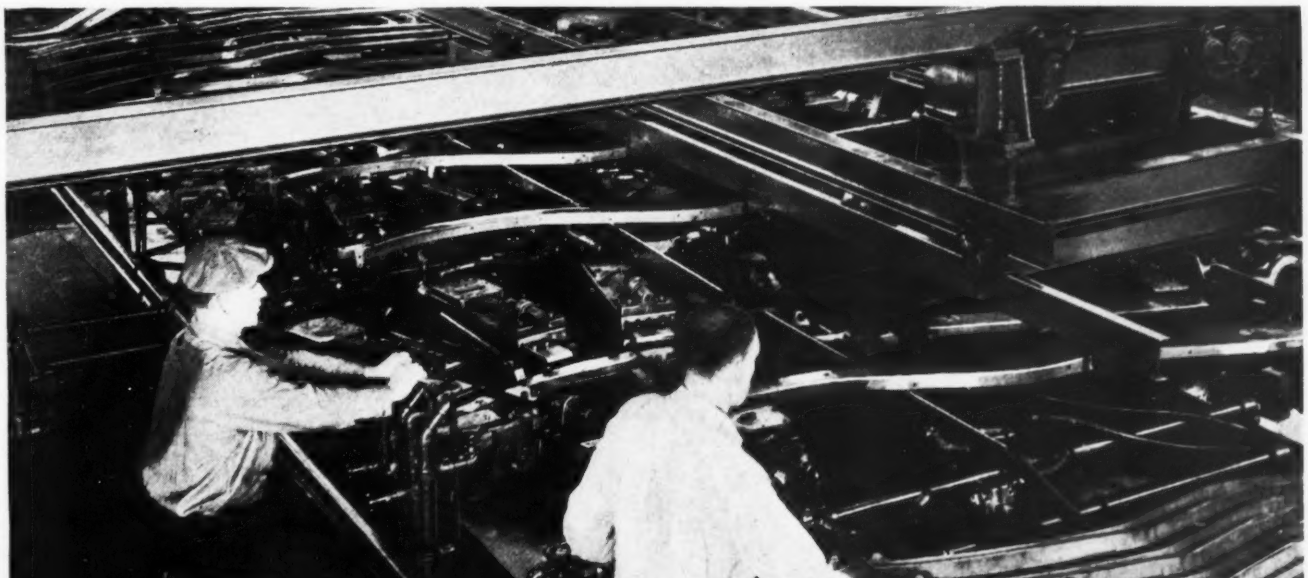
Hydraulic Multiple Piercing of Automobile Frames

All Holes in the Flanges of Side-Rails for Automobile Frames are being Pierced in Four Seconds through the Combined Application of Individual Hydraulically Actuated Units on Machines Built by the Hannifin Mfg. Co.

HIGH-PRODUCTION methods comparable to those prevailing in the various plants of the automotive industry engaged in the manufacture of engines, transmissions, and other mechanical units are employed in constructing the chassis. A striking example is the use of Hannifin multiple-piercing machines at the plant of the A. O. Smith Corporation, Milwaukee, Wis. These machines pierce holes in the side-rails for automobile frames in a machine cycle of four seconds. The machine shown pierces all top and bottom flange holes.

Four of these multiple-piercing machines are installed in this plant. Each machine has twelve or fifteen hydraulically operated piercing units, spaced to suit the side-rails. The units are arranged for piercing holes at the required angles in various planes. Two sizes of piercing units or ram heads with capacities of 17 1/2 or 25 tons and 35 or 50 tons are used. The hydraulic cylinders for operating the ram heads are made in four sizes, of 17 1/2, 25, 35 and 50 tons. The cylinders are interchangeable, so that cylinders of greater or lesser capacities can be substituted, as required.

The use of individual units makes it possible to pierce holes in groups by locating the units in different planes and at various angles. As many as five or six holes are punched by one of these units. The side-rails are usually 3/32 or 5/32 inch thick for passenger cars, and 7/32 inch thick for trucks. The holes punched are of different sizes, ranging from 17/64 to 3/4 inch in diameter.



One of the Hydraulically Actuated Multiple-piercing Machines Employed by the A. O. Smith Corporation for Simultaneously Punching Top and Bottom Flange Holes in Side-rails for Automobile Frames

In the design of the hydraulic piercing units, the width has been kept to a minimum, so as to enable the units to be installed close together. Compactness has been made possible by designing the units to operate at extremely high pressures, the regular working pressure being 5000 pounds per square inch. A machine with a combination of piercing units is capable of applying power to the extent of more than 700 tons.

The moving ram of each unit is made integral with a rectangular-shaped head that carries the punches. The ram head reciprocates in two bronze bearings that are pressed into each end of the ram housing. An oil well or chamber is provided between the bronze bearings. The hydraulic cylinders are double-acting, so that stripping of the work from the punches is accomplished by hydraulic power rather than by springs. In some cases, spring-loaded pressure pads are used, and in other instances rubber blocks.

All the hydraulic units are connected to manifolds, so that the units operate from a common pressure generator. In order to obtain the required speed and capacity, four Hannifin "Hy-Power" pressure generator units are mounted in a common tank. They are interconnected and interlocked, so that while each generator unit is operated by its own motor, all the units operate simultaneously throughout the complete cycle of the machine.

When four pressure units are mounted in one tank, it is common practice to operate three of the units simultaneously and keep the fourth as a reserve. By having one unit in reserve, it is possible to make minor adjustments of the equipment without the slightest interruption to production. Another advantage of installing four pressure generators in one tank, is that the generators can be operated in tandem and a tonnage capacity obtained that would otherwise be possible only by using much larger hydraulic pumping units requiring much greater horsepower.

The operating cycle of the individual piercing units consists, first, of a rapid advance stroke until the punches touch the work; second, an automatic high-pressure working stroke; third, an automatic reversal of the ram stroke at peak pressure; and fourth, a rapid return stroke. The pressure generator is idle at zero pressure between cycles of the machine.

The work clamps are air-operated on the machine illustrated. In some installations, an air-operated lifting mechanism is also provided to facilitate lowering the side-rails into the piercing position and raising them after the operation has been performed.

* * *

Heat-Treatment Equipment at the Rock Island Arsenal

The accompanying illustration shows a general view of the furnace equipment in the heat-treating department of Rock Island Arsenal. In the foreground is a Leeds & Northrup "Hump" furnace used for tool hardening under controlled atmosphere. The department also contains three Homo-furnaces, one as large as 42 inches in diameter by 60 inches deep, which is used for heat-treating aluminum and other parts. In the background is a Homo-nitriding furnace, 21 3/4 inches in diameter by 26 inches deep, for the nitriding of bearings, bushings, and other parts required for tanks and combat cars, as well as links and brackets for other mechanized Army units. This furnace operates on the forced convection principle.

Heat-treating Department at the Rock Island Arsenal

Vultee Methods Speed Production of Fighting Planes

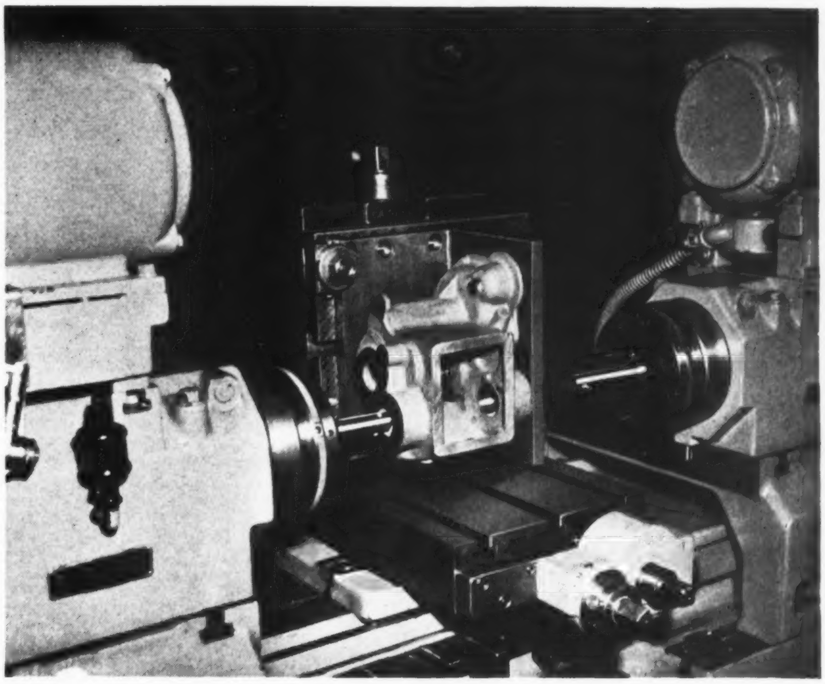


Fig. 9. Precision Boring Machine Employed for the Accurate Finishing in Line of Two Sets of Bores in Control Transmission Cases

Manufacturing Methods Followed in Building Airplanes on a Straight-Line Production Basis. Second Installment

By HAROLD M. HARRISON
Factory Superintendent
Vultee Aircraft, Inc.

MANUFACTURING practices that have speeded up the production of military airplanes in the plant of Vultee Aircraft, Inc., Downey, Calif., were described in the first installment of this article, which appeared in July, 1940, MACHINERY, page 170. Of especial interest were the milling of aluminum parts at a cutter speed of 10,000 R.P.M., and the application of rotary tables in routing and sheet-metal forming operations. This installment will describe several operations performed on standard machines, as well as welding and punching methods.

The standard machine tools recently installed include an Ex-Cell-O precision boring machine, which is shown in Fig. 9 being used for the accurate finishing of a control transmission case. The part is a magnesium casting. Two holes are bored in line in one set-up, and then the position of the casting is changed to bring another set of holes in line with the tools. In each case, a bore is finished from a cored hole by both heads within a tolerance of plus 0.0005 inch minus nothing. One tungsten-carbide cutter is provided on each boring spindle.

The machining of a quadrant casting for a flap-operating mechanism is performed, as shown in Fig. 10, on a Milwaukee manufacturing type milling machine. The operation consists of finishing two inner and one outer boss surfaces, which are held within a dimensional tolerance of plus or minus 0.002 inch. The odd shape of the part requires that it be held on an angular fixture, and that both the longitudinal and crosswise movements of the table be employed for moving the cutter into and out of the working position. The sides

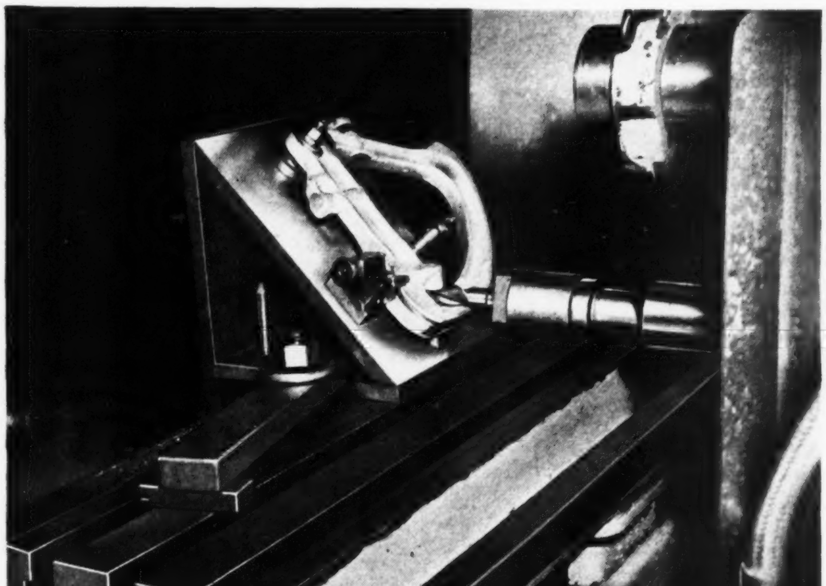


Fig. 10. Set-up Employed on a Milling Machine for Machining Inner and Outer Surfaces of Bosses on an Odd-shaped Casting

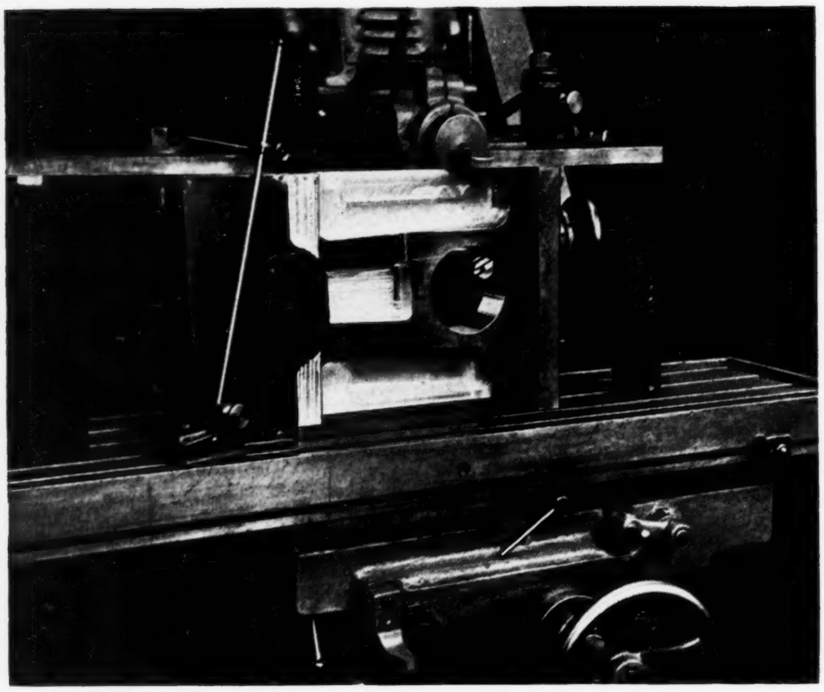


Fig. 11. Milling Machine Operation that is Typical of the Work Required in Aircraft Plants when Parts are being Turned out for the First Plane of a New Design

of a helical end-mill are used to machine the boss surfaces.

Fig. 11 shows a Van Norman milling machine being used on an experimental job rather than a production operation. Stock was routed out on the aluminum-alloy ingot according to scribed lines, and then the hole was drilled and bored, all of this work being performed on the milling machine. At the time the photograph was taken, the machine was set up for finish-boring the hole with a fly cutter. A fly cutter was also used after the boring operation to finish the entire back of the ingot, so as to eliminate any warpage that may have been produced by the severe routing and boring cuts.

By the development of sturdy revolving jigs, Vultee engineers have been able to adopt a wholly arc-welded tubular construction for the fuselages of combat and trainer planes. In Fig. 12 is shown a general view of a fuselage assembly jig. The end bays of the fuselage frame are assembled on a jig member, located in the middle of the tracks, which are about 3 feet above the floor, while the side panels are likewise welded together on jig members at the ends of the tracks. The three jigs can be revolved into any plane, enabling all arc welds to be made with the electrodes held upright. When the end bays and side panels have been completely welded, the side-panel jigs are rolled up to the central jig, as shown, for welding the side panels to connecting struts of the end bays. Chromium-molybdenum steel tubing is used in fuselage fabrication, together with brackets and strips of the same material.

After a fuselage frame has been completely welded, it is sand-blasted all over, and then oil is applied under pressure to the inside of the tubular structure to detect any possible pin-holes in the welds. The fuselage is next painted, after which it goes to the final alignment drill jig, which insures interchangeability of all fuselages.

Considerable spot-welding is also done on pieces that are not called upon to withstand heavy stresses. In Fig. 13 is shown an Acme spot-welder of 110 kilovolt-ampere rating, which is used for a large amount of production work. The job illustrated is the welding of small brackets to a jig for fuselage skins. There are also two Sciaky spot-welders of much greater capacity used for the spot-welding of the side panels, cowling, fairing, and control surface assemblies.

A standard type of machine that saves much time in the sheet-metal department is the Wiedemann turret punch shown in Fig. 14, which is equipped with eighteen punches

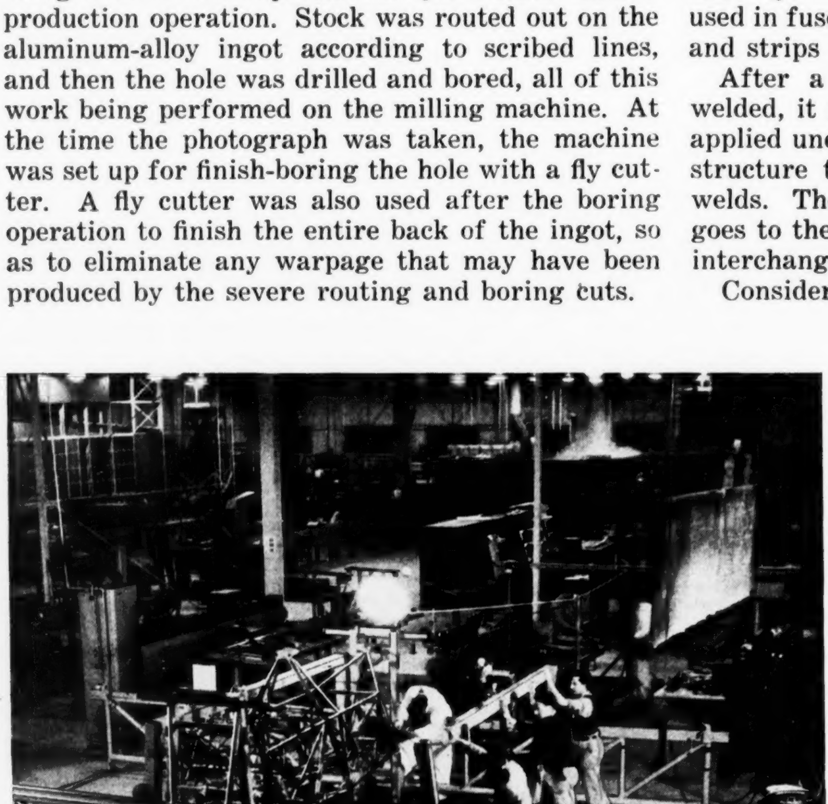
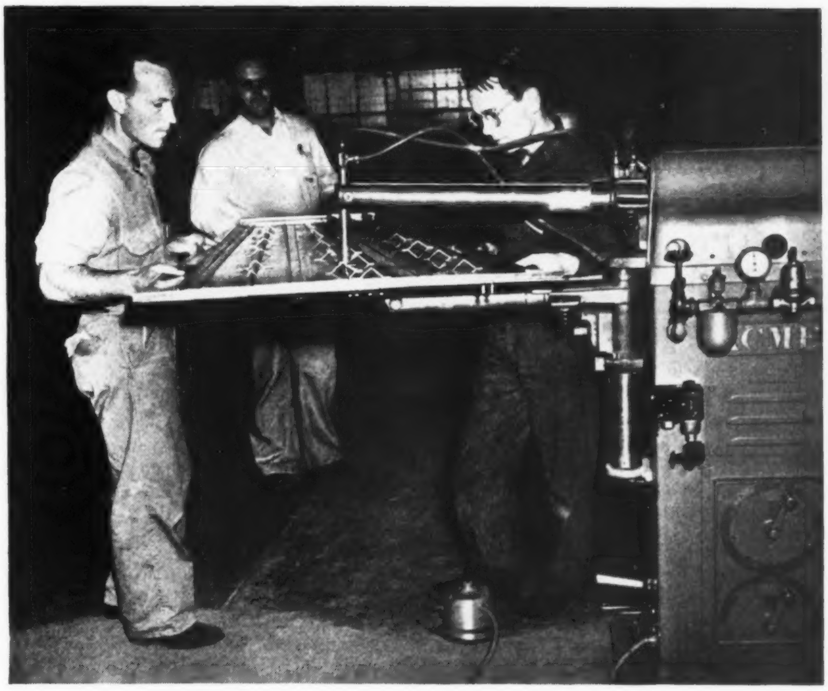


Fig. 12. General View of a Three-unit Revolving Jig Used in the Arc Welding of Fuselages for Combat and Trainer Airplanes

Fig. 13. Spot-welding a Series of Brackets to a Jig Required for Automatically Punching and Riveting Fuselage Skins and Stiffeners on Automatic Riveters



of different sizes, ranging from 1/16 to 1 inch in diameter for punching chromium-molybdenum steel sheets up to 1/16 inch thick, and from 1 to 1 1/2 inches in diameter for punching sheets of the same material up to 1/8 inch thick. It will be seen that, with this arrangement, a punch of the required size can be instantly selected. This machine is employed on a large variety of parts in which holes must be punched to true circles.

* * *

In 1930, through the assistance of the National Bureau of Standards, Washington, D. C., a commercial standard (CS8-30) on Plain and Thread Plug and Ring Gage Blanks was accepted by industry. In October, 1940, on recommendation of the American Gage Design Committee, a revision to cover additional types, and minor revisions in some existing types, was submitted to the industry for acceptance. Those concerned have since approved of this revised standard, which became effective for new production January 1, 1941 (and for clearance of existing parts, January 1, 1942). Copies of the new standard can be obtained by those interested by addressing the National Bureau of Standards, Washington, D. C.

* * *

One of the important materials for which the United States is dependent on foreign sources of supply is tin. According to the *Compressed Air Magazine*, the Standard Steel Spring Co. has developed a process whereby first nickel and then tin are applied to steel sheets in layers. The process is electrolytic, and is known as "Corronizing." The cost of coating with a thin coat of the two materials is said to be the same as when using tin alone; but by the new plating method, the consumption of tin is cut in two.

Welding Course for Aviation Industry

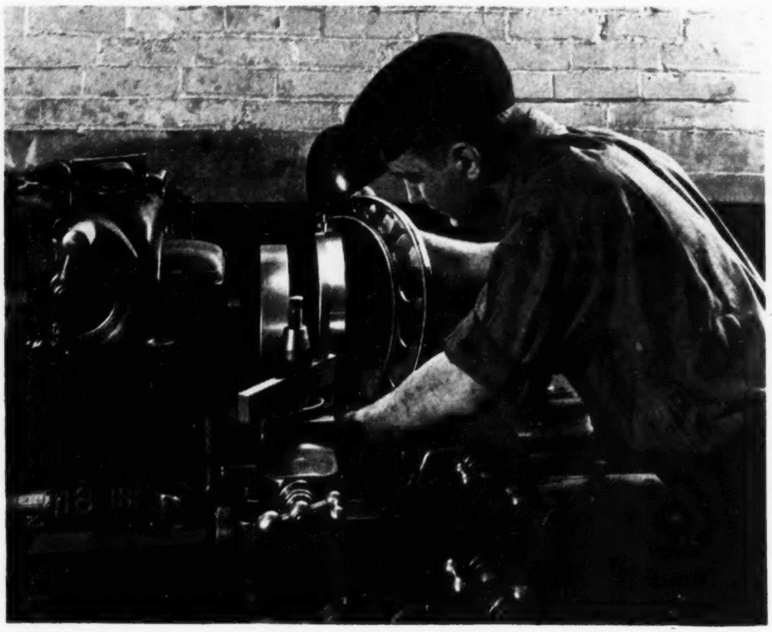
A comprehensive course of exercises covering the oxy-acetylene welding processes in the aviation industry has been published by Air Reduction, New York City. The purpose of the course is to provide a well planned series of exercises—sixty-seven in number—to illustrate all the varied conditions existing in the art of aircraft welding. It can also be utilized to train operators who have had previous experience in other lines of oxy-acetylene welding. The book can be obtained at the price of 50 cents per copy from the Air Reduction Sales Co., 60 E. 42nd St., New York City.

Fig. 14. Turret Punching Machine with a Large Number of Punches, from 1/16 to 1 1/2 Inches in Diameter, for Punching Holes through Sheet Metal

How Carbide Tools Reduce

A Detailed Account, with Specific Examples, Indicating How Machining Costs have been Reduced at the Nuttall Plant of the Westinghouse Electric & Mfg. Co. through the Use of Carbide Tools

By W. J. WILLIAMS, Superintendent
Westinghouse Gearing Division
Pittsburgh, Pa.



In Machining Heat-treated 0.40 to 0.50 Per Cent Carbon Steel Gears (7 7/16 Inches in Diameter, 1 Inch Face, 255 Brinell), Carbide Tools Reduced Tool Costs 50 Per Cent

DURING the last few years, there has been a vast improvement in cemented-carbide tools, and it has been found possible to apply these tools successfully to steel turning. The research conducted by the manufacturers of carbide cutting materials has resulted in these materials being utilized to an ever increasing extent. It is highly essential that the type of tool and the grade of carbide that can be used advantageously with the equipment available should be thoroughly understood. Data are now available that make it possible to select the correct grades of carbide for economical steel turning, as well as the rake and clearance angles and the chip breakers that will give the best results.

One of the important factors to consider in selecting the type of tool best adapted for a specific application is the steel to be cut—whether plain carbon forged steel, untreated or heat-treated; alloy forged steel, untreated or heat-treated; or cast steel, plain carbon or alloy, untreated or heat-treated. Each of these classifications will require a different grade of carbide tool if the greatest economy is to be expected. The angles in grinding the tool would also change for each application.

Table 1. Machining Forged-Steel Shafts

	High-Speed Steel	Cemented Carbide
Average Shafts per Tool Grind	3	8
Cubic Inches of Shaft Metal Removed per Tool Grind	324	864
Number of Grinds per Tool	30	37
Number of Shafts per Tool	90	296
Average Cost of Tool	$8.00	$24.00
Time Allowed per Shaft	1.50 hrs.	0.66 hr.
Tool Cost per Shaft	$0.09	$0.08
Tool Grinding Cost per Shaft	.....	0.04
Labor Cost per Shaft	1.31	0.57
Total Cost per Shaft	$1.40	$0.69

Only the shear angle remains fairly constant at 15 or 20 degrees, the latter being preferable.

The size of the chip breaker—that is, the width, depth, and amount of rake ground into the chip breaker—must be considered for each of these applications, since the curling of the chip would be different in each case, and this is the most important single factor in causing excessive wear and breakage of carbide tools. However, with the proper selection of clearance angles and size of chip breaker, the chip slippage under the cut can be made so free as to reduce the amount of power required for the cut as much as 40 per cent in the case of turning steel. Since the horsepower is reduced by this amount, it is obvious that the pressure on the tool is correspondingly reduced, thereby assuring longer tool life.

The economies that can be derived from carefully selecting the grade of carbide to be used for steel turning are indicated by the examples quoted in the following. Table 1 gives data pertaining to turning a forged-steel shaft, untreated, having a Brinell hardness of approximately 190; about 108 cubic inches of metal were to be removed. The shaft was turned at a surface speed of 350 feet per minute, and a feed of 0.020 inch per revolution. The tool used was a tough, hard carbide of approximately 90 Rockwell A.

It will be noted from the table that, in this case, the net saving per shaft, including both labor and tool cost, was $0.71; in other words, the cost was practically cut in half. It will also be noted that

the Cost of Machining Steel

In Turning the Inside and the Outside and Facing a Heat-treated 0.40 to 0.50 Per Cent Carbon Steel Ring Gear, the Use of Carbide Tools Reduced Tool Costs 51 Per Cent

the tool cost per shaft was $0.08 using a carbide tool, as compared with $0.09 using a high-speed steel tool. These figures were determined through actual production tests. The life of the high-speed steel tool was 90 shafts, and of the carbide tool 296. Although the cost of the carbide tool was in the proportion of 3 to 1, as compared with the high-speed steel tool, the cost of removing a cubic inch of metal was 9 per cent less with the carbide tool.

At this point, it may be mentioned that in any analysis of cutting tools the tool life should preferably be based on the amount of metal removed in cubic inches. Often we are misled by comparisons in which the value of different types and grades of tools is based on the number of pieces turned per grind of the tool. It has frequently been found that the number of pieces produced per grind may have been less on one application than on another or less with one grade of carbide than with another. However, the wear which necessitates the grinding of the tool may be of less importance when the full life of the tool is taken into consideration.

It has been found at the Westinghouse-Nuttall plant that the tough carbides (89-90 Rockwell) will wear much faster in some applications than the harder grades (92-93 Rockwell). However, the tougher grades will stand much more abuse, and the tool bit can be used to a much smaller size, since it will not crack when the carbide becomes worn to a thin point. Hence, a true comparison can only be obtained by taking into consideration the full life of the tool, based on adequate records of the amount of metal removed in cubic inches. Such an analysis will prevent one from being misled when a grade of tool produces a very large number of pieces per grind for a short time, since tools of this grade may have their life reduced considerably by cracking or cratering. The figures in Table 1 are based on production records covering a total of 350,000 cubic inches of metal removed.

Another example of comparative costs is shown in Table 2. Here we are dealing with a heat-treated, 40 to 50 point carbon-steel shaft, 6 3/4 inches in diameter, 51 inches long, with a Brinell hardness varying from 269 to 325. The depth of cut ranges from 1/4 to 1/2 inch; the cutting speed is 280 feet per minute; the feed, 0.020 inch.

It will be noted that the actual saving in this case was $1.53 per shaft, or 47 per cent. It will also be noted that the tool cost per shaft was reduced approximately 30 per cent. This, again, illustrates the advisability of basing an estimate of tool cost on the full life of the tool as expressed by the volume of metal removed.

The results of another production performance are recorded in Table 3. Here 226 cubic inches of metal were removed from a cast-steel gear 27 1/2 inches in diameter, 7 inches face width, 30 to 40 point carbon steel, untreated, with a Brinell hardness of approximately 180. The cutting speed is 240 feet per minute, and the feed 0.18 inch. In this case, the saving is $0.17 per gear, or 12 1 /2 per cent. It will be noted that the tool cost per gear is higher for carbide tools than for high-speed steel tools. This, however, is justified, because there is a net saving of $0.17 per gear due to the saving in machine running time, which results in greater production per machine hour.

In a case of this kind, it is obvious that if the full life of the tool were not taken into considera-

Table 2. Machining Heat-Treated Steel Shafts

	High-Speed Steel	Cemented Carbide
Average Shafts per Tool Grind.....	1/2	4
Cubic Inches of Metal Removed per Tool Grind	160	1,284
Number of Grinds per Tool........	30	16
Number of Shafts per Tool.........	15	64
Average Cost of Tool..............	$8.00	$24.00
Time Allowed per Shaft............	3.06 hrs.	1.4 hrs.
Tool Cost per Shaft................	$0.53	$0.37
Tool Grinding Cost per Shaft.......	.....	0.07
Labor Cost per Shaft...............	2.66	1.22
Total Cost per Shaft.............	$3.19	$1.66

Table 3. Machining Cast-Steel Gears

	High-Speed Steel	Cemented Carbide
Average Gears per Tool Grind	2	8
Cubic Inches of Metal Removed per Tool Grind	452	1,808
Number of Grinds per Tool	30	14
Number of Gears per Tool	60	112
Average Cost of Tool	$8.00	$24.00
Time Allowed per Gear	1.43 hrs.	1.09 hrs.
Tool Cost per Gear	$0.13	$0.21
Tool Grinding Cost per Gear	.....	0.04
Labor Cost per Gear	1.23	0.94
Total Cost per Gear	$1.36	$1.19

tion and the tool cost measured by the number of cubic inches of metal removed, the carbide tool might lose out, because it would be considered uneconomical, on account of the high tool cost per gear. Too much stress cannot be placed upon a complete analysis for evaluating the total machining costs.

The next example is analyzed in Table 4. Here we deal with the same gear, except that, in this case, the gear is finish-turned on the outside diameter and faced on the side after heat-treatment. The Brinell hardness is 302; 36 cubic inches of metal are removed; the cutting speed is 180 feet per minute; and the feed 0.18 inch.

It will be noted that a saving of $0.70, or 41 per cent, per gear was obtained in this example, and the tool cost per gear was reduced by about 30 per cent. Table 4 indicates that, on heat-treated steel, the cost of the carbide tool per cubic inch of metal removed is less than the cost of the high-speed steel tool, while Table 3 shows that the reverse is true when untreated steel is machined. This is due to the fact that the harder metal being cut subjects the high-speed tool to more severe service than is the case where untreated steel is machined.

Table 5 records the results obtained in machining a ring gear made from 40 to 50 point carbon steel, heat-treated, with a Brinell hardness of 350, the cubic inches of metal removed being 218. The cutting speed is 180 feet per minute, and the feed 0.18 inch. In this case, a carbide tool was used for turning the outside diameter, the face, and the inside diameter. With the carbide tool, it was possible to obtain a fine enough finish and to maintain accuracy without taper in the bore. This eliminated the grinding of the bore, which was required when high-speed steel tools were used. The grinding cost incurred when using high-speed steel tools is included in the table.

Table 4. Machining Gears after Heat-Treatment

	High-Speed Steel	Cemented Carbide
Average Gears per Tool Grind	1	8
Cubic Inches of Metal Removed per Tool Grind	36	288
Number of Grinds per Tool	30	16
Number of Gears per Tool	30	128
Average Cost of Tool	$8.00	$24.00
Time Allowed per Gear	1.66 hrs.	0.89 hr.
Tool Cost per Gear	$0.27	$0.19
Tool Grinding Cost per Gear	.....	0.04
Labor Cost per Gear	1.43	0.77
Total Cost per Gear	$1.70	$1.00

Again, we note that the saving per gear amounted to $3.92, or 51 per cent. The carbide tool cost per gear shows a saving of 50 per cent, this large saving being due to the excessive wear of high-speed steel tools when turning this type of heat-treated steel.

It should be noted that, in all the cases referred to, the tool grinding cost for the high-speed steel tools is included in the labor cost allowed per shaft or gear, since, with high-speed steel tools, the lathe operator performs his own tool dressing, whereas in the case of carbide tools, the tool grinding cost is shown separately, as the tool dressing is done in the tool-room by an operator detailed to do this.

One more example of the use of carbide tools for turning heat-treated steel may be quoted. In this case, the grinding of the outside diameter of a gear blank is eliminated by finish-turning it with carbide tools. In the rough-turning operation, variations of as much as 1/16 inch on the diameter are encountered. The rough-turning, obviously, is done before heat-treatment. After heat-treatment, this amount of stock can be removed in one cut with a carbide tool, whereas the grinding cost varies in direct proportion to the amount of stock to be removed.

Table 5. Machining Heat-Treated Ring-Gears

	High-Speed Steel	Cemented Carbide
Average Rings per Tool Grind	1/2	5
Cubic Inches of Metal Removed per Tool Grind	109	1,090
Number of Grinds per Tool	30	17
Number of Rings per Tool	15	85
Average Cost of Tool	$8.00	$24.00
Time Allowed per Ring, Turning	4.90 hrs.	3.53 hrs.
Time Allowed per Ring, Grinding	2.70 hrs.	.....
Tool Cost per Ring	$1.06	$0.53
Tool Grinding Cost per Ring	.....	0.10
Labor Cost per Ring, Grinding Inside of Bore	$2.32	.....
Labor Cost per Ring, Turning Inside of Bore	4.20	3.03
Total Cost per Ring	$7.58	$3.66

In the case of a heat-treated gear blank—forged steel, 40 to 50 point carbon; 255 Brinell hardness; 7 7/16 inches outside diameter and 1 inch face—the outside is turned with a carbide tool in 0.04 hour each, whereas the grinding required 0.08 hour, a reduction in time of 50 per cent.

Importance of Care of Carbide Tools

The care of carbide tools by the operator is an important factor in the life of a tool. The operator should be given full instructions as to the use and care of these tools, together with a chart showing

the grade of carbide to be used for various types of steel and the feeds and speeds to be employed.

The grinding of these tools must be done with utmost care, because careless grinding, the use of an unsuitable wheel, or too much pressure exerted on the tool while grinding may cause fine hair-line cracks on the polished surface, not visible to the eye. These cracks will tend to open up under the pressure of the cut and result in breakage of the tool.

Another important factor in prolonging the life of these tools is the care used by the operator in removing the tool before it is worn too badly. It has been found that the greatest life of these tools can be obtained when the amount of stock removed from the tool in redressing averages from 0.013 to 0.015 inch. When a tool is used too long before regrinding, so much stock has to be removed in the grinding operation that there is danger of generating heat, as well as of setting up cracks in the tool under the pressure of the cut. The high pressure exerted on the tool in order to remove an excessive amount of stock after the cutting edge has been dulled too much sets up a cratering action which has an injurious effect on the carbide for a considerable depth.

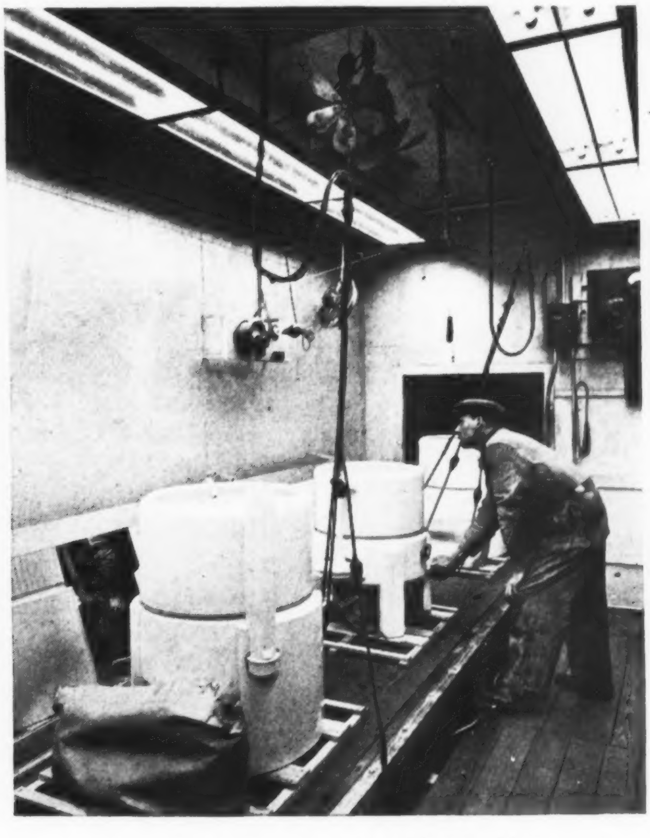
Improved Illumination—Before and After

The two accompanying photographs show what a striking change can be made in artificial lighting without increasing power costs. To the left is shown an inspection booth in the plant of the Apex Electric & Mfg. Co., Cleveland, Ohio, when the old lighting system was used. Six reflectors, each equipped with a 200-watt daylight incandescent lamp, provided about 50 foot-candles of illumination on the inspection line. The lamp brightness was high, resulting in annoying direct and reflected glare, and the amount of radiated heat caused discomfort. To the right is shown the same inspection booth with fluorescent lighting. Six twin-lamp Westinghouse luminaires, each utilizing two 48-inch, 40-watt fluorescent lamps, provide 100 foot-candles of glareless, cool illumination.

* * *

The radical, who has tried to stigmatize "profit" as something unholy, un-American, and un-social, has shot his bolt. The public has learned that profit is not some unclean product fabricated by enemies of society. On the contrary, it is something as necessary to the wages of the worker as to the dividend of the capitalist. Fair profit requires no apology. It is no man's enemy. It is the life blood of the nation and the basis of our American way of life.—*New York World-Telegram.*

Inspection Booth with Old Method of Lighting



Same Booth Illuminated by Modern Means

Engineering News Flashes

World's Largest Generators Nearing Completion

The three water-wheel generators for the Grand Coulee Dam power project in the state of Washington will be, when completed, the largest single power-producing units in the world; they will generate 30 per cent more electric power than any existing machines. The combined output of the three generators will be 324,000 K.V.A.—enough to supply illumination for the cities of New York and Chicago combined. Each generator is 45 feet in diameter and 24 feet high above the generator gallery floor. The rotors are 30 feet in diameter and will turn at a speed of 120 R.P.M. Arc welding is playing a big part in the fabrication of the large steel sections that will make up the finished generators. The first of these generators is just being completed at the East Pittsburgh, Pa., plant of the Westinghouse Electric & Mfg. Co.

X-Ray Machine for Inspecting Castings and Welded Parts

To check the interior of castings and welded parts that go into the products of the Erie Works of the General Electric Co., for the purpose of detecting concealed flaws in the metal, castings and other metal parts are X-rayed before machining operations are started. The industrial X-ray equipment shown in the accompanying illustration is used for this purpose. In the Erie Works, this equipment has been found especially useful in the investigation of materials for armature and commutator spiders and a great number of fabricated parts.

The equipment is mounted on a truck. It is completely shockproof, all high-voltage equipment, including the X-ray tube and the high-voltage transformer, being oil-immersed in a grounded metal case. The control panel is mounted in a lead-lined booth at the rear of the truck to protect the operator from continual exposure to the X-rays. A machine of this type will penetrate about 3 1/2 inches in steel.

Portable Industrial X-Ray Equipment in Use in the Erie Works of the General Electric Co.

Air-Conditioning Equipment in Blast Furnace Operation

Air-conditioning equipment capable of removing from 7 to 40 tons of water per day from the air blown into a large blast furnace is being installed in connection with a blast furnace at the Aliquippa Works of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., in order to more closely control the quality of the iron produced. This is said to be the first modern air-conditioning unit to be installed in the northern part of the United States for conditioning the air blown into a blast furnace.

The equipment will maintain a constant low moisture content in the air blast, eliminating the necessity of trying to outguess the weather twenty-four hours in advance of charging the furnace. In the past, the fluctuating moisture content of the atmosphere has made it necessary for the operators to constantly change the proportions of the materials charged into the furnace, which approximate 2000 tons of iron ore, 950 tons of coke, 500 tons of limestone, and 4000 tons of air per day, for a production of 1000 tons of molten pig iron.

Ordinarily, wide fluctuations in humidity cause irregular blast-furnace operation, which results in less iron being produced. On hot humid days more coke must be charged per ton of iron to offset the excess moisture in the air, which is blown into the furnace at the rate of 80,000 cubic feet per minute. This air carries with it into the furnace 7 tons of water in twenty-four hours for every grain of moisture content per cubic foot. On days of extreme humidity, this has the effect of pouring from 30 to 40 tons of water into the furnace.

With an air blast of constant humidity, it is pos-

sible to control the silicon content and iron temperature within narrow limits. These are two major factors that have a direct bearing on the quality of the metal. The production can be increased also, with a reduction in the amount of coke and limestone required per ton of iron.

Rare Metal Columbium Used for New Iron Alloy

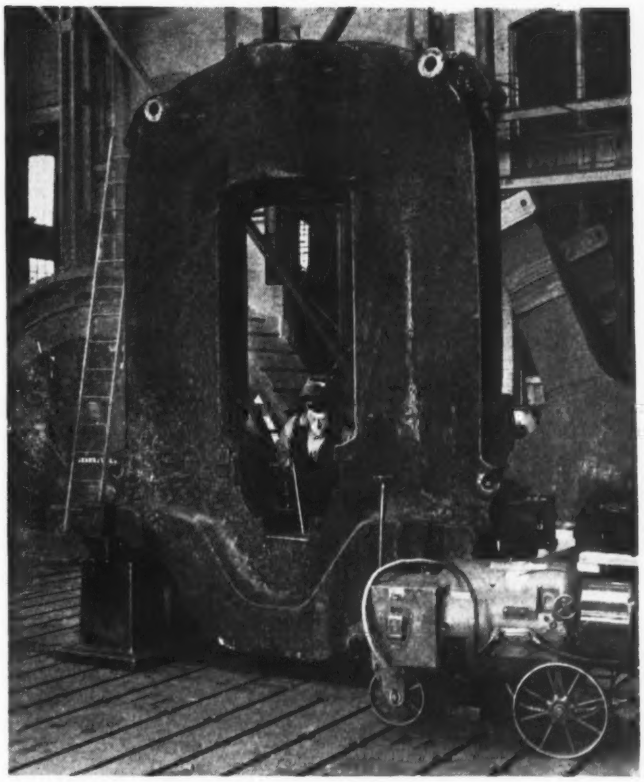
Columbium, a relatively unfamiliar element of slight commercial importance at present, has been found to produce an alloy of exceptional properties when added in small amounts to iron. In experiments conducted by E. P. Parker, of the General Electric Research Laboratory, Schenectady, N. Y., samples containing 3 per cent of columbium, with the balance iron, reveal exceptionally good rupture strength at 1100 degrees F., a temperature not yet commercially used, but being approached by modern high-temperature, high-pressure steam turbines. The iron contains the columbium as a finely dispersed stable compound of iron and columbium. No carbon is contained in the alloy.

Special steels are readily available to meet the demands of turbines operating at today's highest temperatures — about 1000 degrees F. — temperatures sufficiently high to cause the metals to glow. Laboratory investigations have shown, however, that to continue with similar steels having high contents of molybdenum, tungsten, vanadium, or such metals, would mean very expensive steels for turbines capable of successful operation at 1100 degrees or more. Metals flow or creep when subjected to stresses at high temperatures. Although the amount of flow or creep is so minute that it is difficult to measure and seems of slight significance, it is of great importance when the period of years a turbine remains continuously in service and the precise measurements that turbine efficiencies demand are considered.

The columbium-iron alloy has been produced in different ways in the experiments. Correct proportions of the powdered metals have been mixed together, sintered, and the fused mass then swaged into a metal capable of being heat-treated and machined in the usual way. The alloy has also been cast and forged. Investigations have shown the cast alloy to equal the sintered material in its properties, so that commercial production of the alloy is not expected to offer difficulties.

A Repair Job on an Immense Steel Casting

In a large steel plant, a sheet-mill roll frame which was found to be badly worn was quickly repaired by arc welding. The real problem was to get the work done without seriously interfering with production. The mill was shut down Friday night and dismantled, the 41,000-pound steel casting for the housing being delivered to the machine shop of the Canadian Westinghouse Co. at 10 A.M. Saturday morning. The surfaces of both the feet and bearing recess were built up to permit machining to the original size. This required deposits of 405 cubic inches of weld metal weighing 115 pounds. The welding was begun at 11 A.M. Saturday and continued, by means of relief operators, without a moment's interruption, except for two changes of position of the casting, until 8 A.M. Sunday morning, when the casting was handed over to the machine shop for finishing. The illustration above shows the huge casting as set up in the Canadian Westinghouse plant, ready for performing the arc-welding repair operation.



A 41,000-pound Steel Casting Set up Ready for Making Repairs by Arc Welding

Non-Spark Sand-Blast Hose—a Recent Development

To remove any danger of explosion and fire being caused by static generated within a sand-blast hose, a hose has been constructed for this class of work with a special non-spark inner tube and cover. This is a development of the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. The use of specially compounded rubber, according to the manufacturer, prevents the generation of static electricity by the abrasive materials rubbing against the inside or the cover of the hose. The hose, known as the Condor non-spark sand-blast hose, is especially intended for cleaning and preparing castings, removing dust and dirt from metals, and work of similar nature.

EDITORIAL COMMENT

Much criticism is heard of the lag in the Defense Program, but it should be pointed out that definite progress is being made which, while not at present apparent, is the essential foundation for later rapid increases in production. It is true that, except in the machine tool industry, where tremendous strides have been made in stepping up production, the productive capacity of industries engaged in the manufacture of war materials has not yet been spectacularly increased. However, the results of the preparations now being made will be in evidence shortly. While the aircraft industry as a whole has not yet increased production to any marked degree, and there has been no great increase in the number of planes shipped to Great Britain, plants are being built and equipped at the present time, and, when they are in operation, there will suddenly be a very large increase in production.

Industry Could Not Go Ahead Until Given the Signal

The same is true of many other branches of the armament industry. Take shells, for example. At present, the shell production is not very great, but it will take a sudden jump as soon as the plants having orders are equipped with machine tools and gages, ready to go ahead.

The fact that we have been slow in getting under way has not been due to any lag on the part of industry. As far as the Government and the people of the United States are concerned, the handwriting on the wall was perfectly clear in the summer of 1939, if not earlier; but it took our Government and our people almost a year to decide to do anything about it. This unfortunate delay cannot be blamed on industry, for industry would have been ready to start a year earlier, had it received the signal from Government to go ahead. With full Government cooperation, industry will be able to make an even better showing than it did in the last World War.

Training New Men to Avoid Industrial Accidents

Because of the large number of new and inexperienced employes now being engaged by practically all metal-working plants throughout the country, there is likely to be an increase in industrial accidents unless precautions are taken to instruct the new men and learners thoroughly with regard to dangerous practices. It is well worth while to reiterate to these men all the fundamental safety rules familiar to the regular employes. Many accidents can be prevented simply by cautioning the new workers in regard to things that they may never think of as possible causes of accidents, such as loose clothing, flowing ties, the careless touching of moving parts, etc. Men who are regularly employed in mechanical work may consider some of these simple safety precautions too elementary to need repeating; but it is well to remember that many an accident is brought about by actions so obviously dangerous that one sometimes wonders how it happened at all.

Engineering Research Keeps the Wheels of Industry Turning

The value of the research work carried on by industry, and especially by the larger corporations that are able to maintain extensive and well equipped research laboratories, cannot be overestimated. Research is the basis of practically all engineering advance. Without it, such industries as the automobile, tractor, electric power and light (to mention only a few) would still be in their infancy, and the radio, aircraft, rayon, and most of the recent chemical industries would not exist at all.

Not only is research the basis of scientific and engineering advance, but upon it rest the possibilities for increased industrial employment, higher wages, more leisure, and better living conditions. A nation like the United States, which depends so largely for its well-being upon its industrial advance, can, therefore, ill afford to do anything to discourage scientific and industrial research. The foolish yet tenacious notion that research reduces employment by encouraging engineering advance and increased application of machinery, must be combated at every turn. It is research that has created the employment of the millions who are now working in the more recently developed industries based on the research workers' achievements. It is research that makes possible the comforts of present-day life.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

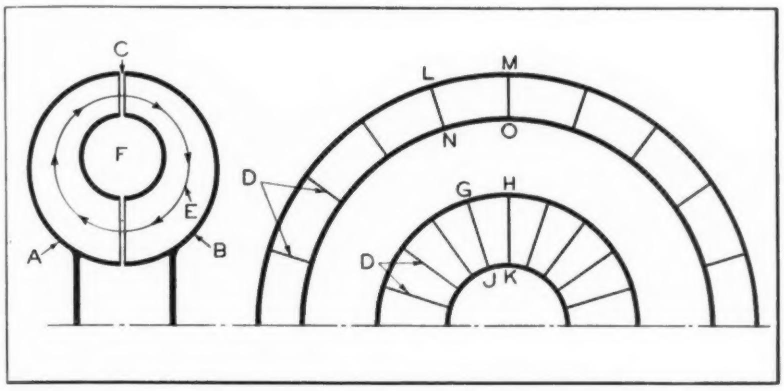


Fig. 1. Diagram Showing General Arrangement of the Fluid Coupling in the Oldsmobile Hydra-Matic Drive

Couplings of the Fluid or Hydraulic Type

Couplings of the fluid or hydraulic type are now being used both in automobile transmissions and in certain industrial applications. With couplings of this general type, the motion of the driving member is transmitted to the driven member through the medium of an oil fluid rather than by direct physical contact. The effectiveness of the fluid coupling depends upon this feature, which, in the case of automobile transmissions, for example, permits a gradual shockless acceleration of the driven part up to the point where its speed is nearly the same as that of the driver. The operation of all couplings of this type is due to the action of centrifugal force upon the fluid, in conjunction with the design of the driving and driven members. Just how it is possible to transmit not only motion, but considerable power, through an oil fluid, and without direct contact between the driving and driven members, will be explained in connection with the particular design of fluid coupling used in the Oldsmobile transmission.

The fluid coupling is an important feature in the Hydra-Matic drive of the Oldsmobile cars. While this coupling operates in conjunction with a fully automatic four-speed transmission, the coupling only will be described. The general arrangement of the coupling is illustrated by the diagram, Fig. 1. An impeller A and a runner B are enclosed in a housing containing an oil fluid selected to function under a wider range of temperatures than are likely to be encountered. The impeller is driven by the engine (through a planetary gear set which, when in reduction, brings the impeller speed down to about 0.7 of the engine speed), and the runner transmits motion to the rear wheels through the automatic transmission and propeller shaft.

The impeller and runner form an annular channel of circular cross-section, with a small clearance space C between the two members. The semicircular channels in both impeller and runner are divided into cells by a number of radial partitions or vanes D, as shown by that part of the diagram representing a side view. When the coupling is operating, these cells are filled with the oil fluid, which is continually circulated from the transmission housing to the coupling and back, thus preventing any local heating or excessive rise in temperature.

How the Coupling Fluid Transmits Motion

When the engine is started and impeller A begins to rotate, the fluid within the various cells of the semicircular channel in the impeller also receives a circular motion around the coupling axis. At the same time, the fluid in each cell begins to rotate around the cell itself along paths E, as in-

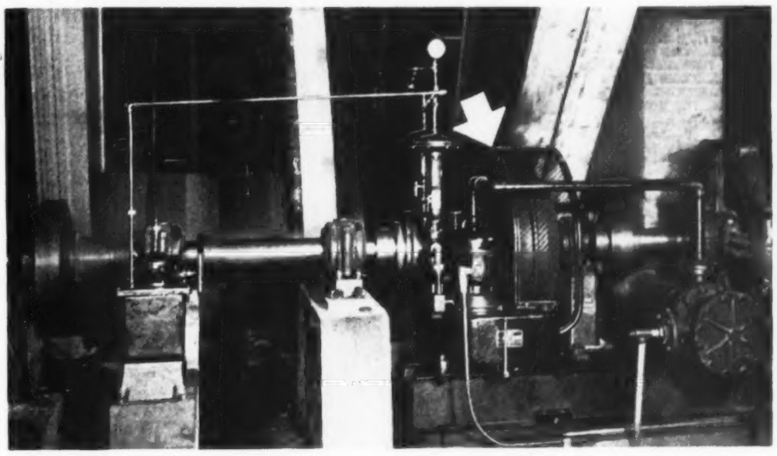


Fig. 2. An American Blower Variable-speed Hydraulic Coupling with a 150-horsepower Synchronous Motor Driving a Paper Machine

dicated by the arrows. The power that can be transmitted from impeller A to runner B depends upon the rate of this transverse rotation. But why does the fluid have such rotation and what causes the runner to be driven by the impeller?

The transverse rotation E is due to the unbalance between the centrifugal force of the liquid in the driving member A and the driven part B. This unbalance is due to the slower speed of B, especially during the starting period. As the speed of impeller A increases, runner B is gradually accelerated until it finally operates at practically the same speed as the driving member, except for a slight lag or slip, which is said to be less than 1 per cent under the ordinary range of driving conditions. As the speeds of the driving and driven members approach each other, this centrifugal unbalance is reduced, and consequently, the rate of transverse rotation or circulation of the fluid decreases. This is accompanied by a reduction in the torque-transmitting capacity of the coupling, but the car is now up to normal operating speed and the coupling has less work to do.

When the transmission gears are shifted to the third- and fourth-speed positions (which, like all shifting, is done automatically), the coupling transmits only about 40 per cent of its full torque capacity. When the impeller and runner are rotating together, we have, then, an annular body of fluid rotating both around the coupling axis and transversely in a number of cells. This whirling mass of fluid has, of course, considerable momentum, and the two sections of the coupling are connected by this fluid body, through which practically all the energy in the driving part is transmitted to the driven member.

Incidentally, it will be noted that the central space F, forming a vortex around which the transverse rotation occurs, is located eccentrically relative to the annular ring formed by the two semicircular parts. The reason for the eccentric location of the vortex is to obtain equal areas at all points in the cells. For example, the area of the opening $GHJK$ at the inner part of the cell, where the circumferential width is less, is equal to the area $LMNO$ at the outer part, where the circumferential width is greater, thus making it necessary to reduce the radial width.

What Happens when the Engine is Idling?

When the foot is off the accelerator and the engine is idling, no motion is transmitted by the impeller to the runner. Why is this so in view of the fact that the impeller is still rotating?

It is evident from the preceding description that the operation of the coupling depends fundamentally upon centrifugal force, which varies according to the *square* of the velocity, in feet per second. Now, when the engine is idling, the transmission is in first gear, and the impeller turns at about 0.7 times the crankshaft speed. Since the square of 0.7 (representing the impeller speed) is about 1/2 of the square of 1 (representing the crankshaft speed) the torque under these conditions is insufficient to start the runner and overcome the resistance of the car to motion or even to slight creeping movements. When the accelerator is pressed down and the engine speed increases, the whirling body of fluid at first impinges against the vanes of the stationary runner, which immediately begins to rotate, the speed gradually increasing until, finally, its vanes, like those of the impeller, are embedded in a rotating fluid body which offers high resistance to any lagging of the driven member. The entire action of the coupling through the accelerating period is such that motion is transmitted rapidly but smoothly through the flexible fluid medium.

Application of Fluid Drive in Paper Mill

Another application of the hydraulic coupling or fluid drive is in driving paper-mill equipment. An American Blower variable-speed hydraulic coupling is shown in Fig. 2 employed in one of the latest paper-mill installations. This coupling is similar in principle to the automotive fluid drive. It provides a smooth transmission of torque without any mechanical connection between the driving and driven members. The hydraulic coupling also provides "stepless" variable-speed control, is readily adaptable to automatic control, permits the use of simple, constant-speed driving motors, eliminates starting shocks, and saves power.

The main drive of a paper machine requires extremely close speed regulation to secure a uniform grade of paper. At present, many paper companies are using sectional drives on their latest machines, with direct-current motors to regulate the draw between sections. In some mills and on earlier installations, a single direct-current motor drives the entire machine through a countershaft from which the individual drives are taken by belts running on cone pulleys. The experience in one mill has shown the plant engineers that they can make excellent paper by using simply an alternating-current motor and a variable-speed hydraulic coupling to drive the countershaft.

The accuracy of speed regulation after six months of almost continuous operation of the machine is unchanged. The control manufacturers guaranteed 1 per cent, and did even better. Tachometer control maintains the paper speed where the operator sets it. Any load fluctuations are automatically compensated for by adding and removing oil from the hydraulic coupling through valves. In the background of Fig. 2, the belt take-offs to the various sections of the machine may be seen. These are on a countershaft which is driven by a silent chain from the hydraulic coupling output shaft. Also note the control valves in the center of the illustration above the manifold; these control valves hold the speed of the countershaft constant

by metering the oil in the hydraulic coupling to suit the load.

The hydraulic coupling is suited to the single motor drive because of its "stepless" speed regulation and lack of mechanical connection, reducing maintenance to a minimum. The simplicity of the electrical system is evident, as only an alternating-current motor and starting equipment are needed; a synchronous motor, with no load starting, can be used to improve the power factor in the mill.

* * *

Plans for Speeding Machine Tool Output

Early in January, plans for speeding up machine tool output to an extent beyond the plans already announced for 1941 were formulated by members of the National Machine Tool Builders' Association at a meeting in Washington, D. C. The following statement was made by the president of the Association, Frederick V. Geier, president of Cincinnati Milling Machine & Cincinnati Grinders, Inc.:

"On December 27, the industry sent a letter to Mr. Knudsen advising him that it could be expected to turn out machine tools to the value of $650,000,000 in 1941. We have now called upon our members to speed up deliveries even further.

"Members of the industry have pledged themselves to increase production beyond the previous promise to Mr. Knudsen and look to the following methods for accomplishing the result: (1) Subcontrating more work to outside concerns: This will bring still more of the country's facilities into prompt production for more machine tools. (2) Employing and training more men: The industry has proved its ability to train new men extensively, and will expand this program. (3) Further plant expansion as indicated by specific needs. (4) Maximum utilization of plants and equipment.

"In his New York speech before the National Association of Manufacturers, Mr. Knudsen said that the machine tool industry 'has set a very good example of speeding up,' and this program is in line with our effort to 'do the impossible again.'

"The industry is fully aware of the difficulties of determining defense requirements for machine tools. We have considered it our duty in the past to point out that the nation's defense job cannot be done effectively unless we are given definite information as to requirements, so that we shall know what is needed, when it is needed, and where it is needed, in the order of critical importance. The members of the industry are very glad to learn that definite plans are now under way on the part of the National Defense Commission to meet our request. We have been assured that every effort will be made to define more accurately the actual machine tool requirements for national defense, and we can promise positive assurance that such definition will be reflected in specific, immediate programs of accomplishment."

* * *

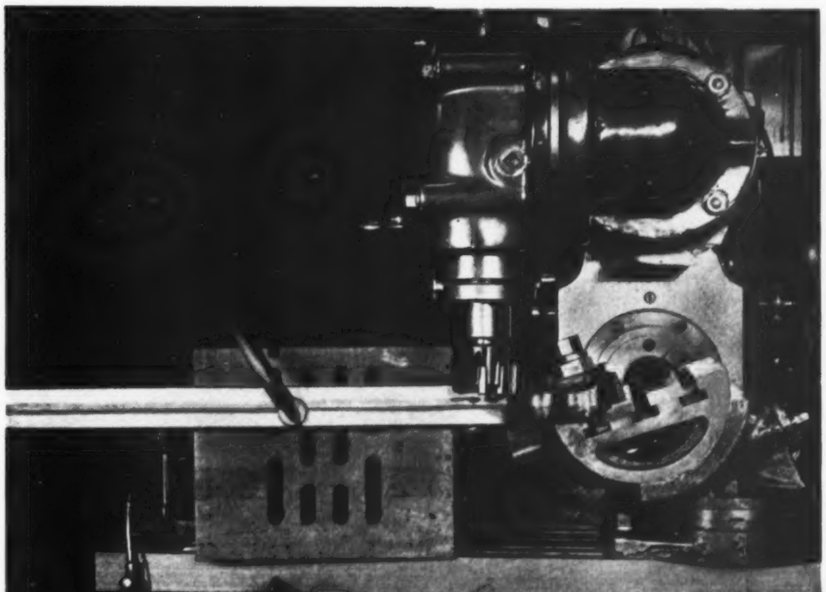
Milling Struts for Airplanes

The application of a Cincinnati vertical-spindle milling machine for finishing airplane landing-gear struts is shown in the accompanying illustration. This operation consists of milling a strut to various angles through the use of a compound angle-plate to which the work is bolted, and an ordinary angle-plate which backs up the work along the extended end. This operation is being performed in the airplane factory of North American Aviation, Inc., Inglewood, Calif.

On the end of the strut seen attached to the compound angle-plate, there are three lugs or bosses in different planes, which must be milled on both sides. After being milled, the lugs are drilled and bored on the same machine. The opposite end of the strut is milled on both sides in a different set-up of the machine, and is drilled, bored, and counterbored as well.

* * *

We hear too much today about what the individual has a right to expect from the Government, and too little of his obligations to his country.



Milling Machine Set up for Finishing the Ends of Landing Gear Struts to Various Angles

Canadian Methods of Producing

Fig. 13. Each Rifling Land in the Barrel is Checked by Sighting the Barrel in a Lighted Cabinet and Turning it Slowly

Second Installment of an Article that Describes Many Operations Involved in Producing the Light Machine Guns Used by British Armies the World Over

OPERATIONS performed in machining barrels, bodies, and slide butts for the Bren light machine guns in a Canadian plant were described in the first installment of this article, which was published in January MACHINERY, page 160. The second installment will complete the description of barrel finishing operations and will deal with methods employed in machining other gun parts.

Upon the completion of the lapping, as described in the previous article, the barrels are again examined for straightness, this time by sighting the barrels into a housing, as shown in Fig. 13, in which artificial light is provided. By rotating the barrel, the inspector is able to follow each rifling land the complete length of the barrel and detect any imperfections.

Three different milling operations are performed on the gun barrel by the Kent-Owens hand milling machine seen in Fig. 14. First a barrel is placed lengthwise in the fixture at the back of the table, as shown, for milling two sides of keyway lugs. Then it is placed crosswise in a second fixture, which extends beyond the front of the table, for milling a groove to receive a taper pin, and also for milling a keyway at a point farther along the barrel. The setting of the barrel must be changed for taking these two cuts.

Three slots are broached through threaded nut barrels to form interrupted threads on a Lapointe horizontal broaching machine equipped as shown in Fig. 15. Each slot extends through an arc of 60 degrees, as will be apparent from the two pieces seen at the front of the machine, one of which is unbroached and the other broached.

For the broaching operation the piece is placed on the machine fixture with a leg on the part extending upward against a locating plug. A slender pin is then inserted through a hole in the part and into a dowel-hole in the fixture face to insure location of the broached slots with respect to a finished surface on the leg. The slots are completely broached with one pull stroke of the machine.

An interesting machine set-up employed later for milling the same pieces part way around a circular boss to an angle, is shown in Fig. 16. The machine is a Cincinnati vertical-spindle milling machine equipped with a fixture having a worm drive, which is actuated by turning a crank-handle to revolve the work past the cutter through the required arc. Stops limit the rotating movement of the table. The

Fig. 14. Hand Milling Machine Set up for Performing Three Operations on the Gun Barrels

the Bren Light Machine Gun

face of the fixture is inclined, so as to present the end of the boss being milled at the desired angle to the cutter.

Piston grip screws are being produced from bar stock at high speed by the Bardons & Oliver turret lathe shown in Fig. 17. In this operation, the stock is first fed to a stop on the hexagon turret. Then the stock is rough-turned and centered by tools on the multiple-cutter turner seen in the operating position. Two tool bits on this attachment turn the bar for a length of approximately 3 3/16 inches. The fourth face of the turret is then indexed into position for drilling a hole of 0.500 inch diameter for a length of approximately 3 inches. At the same time a tool on the front of the cross-slide turns the end of the bar to a thread diameter.

After the hexagon turret has again been indexed, a spot-facing tool machines the work to length. At the same time, the square turret on the cross-slide is indexed to bring two cutters into position for turning shoulders on the end of the work nearest the chuck. The die-head on the sixth face of the turret next cuts a short thread on the front end of the piece, and while this cut is in progress, a tool on the square turret turns a clearance back of the thread to almost the head end of the piece. Finally, the part is cut off by a tool on the back of the cross-slide.

In the foreground of Fig. 18 are seen two pieces of sheet steel that are welded together to make a cartridge magazine, and also one of the welded magazines. These pieces must be welded together with great care, as there is an allowance of only 0.010 inch across the width of the magazine, and the welding must be performed without excessive flash and without bubbles in the weld. Also, good penetration of the weld is essential.

The operation is performed with the General Electric atomic hydrogen arc-welding equipment seen in this illustration. Four pieces to form two magazines are loaded at one time into simple jigs in such a way that the edges to be welded just touch each other along their full length. These jigs are then mounted, one at a time, on the work-head of the machine, as shown, the work-head being revolved to carry the jig beneath the welding head. There are two positions of the welding head, so that the electrodes can be applied on both sides of the jig for welding the two sides of the magazines.

With this equipment, even seams are produced along both the inside and outside of the welded edges. When the magazines are buffed, it is almost impossible to see where the two pieces of sheet

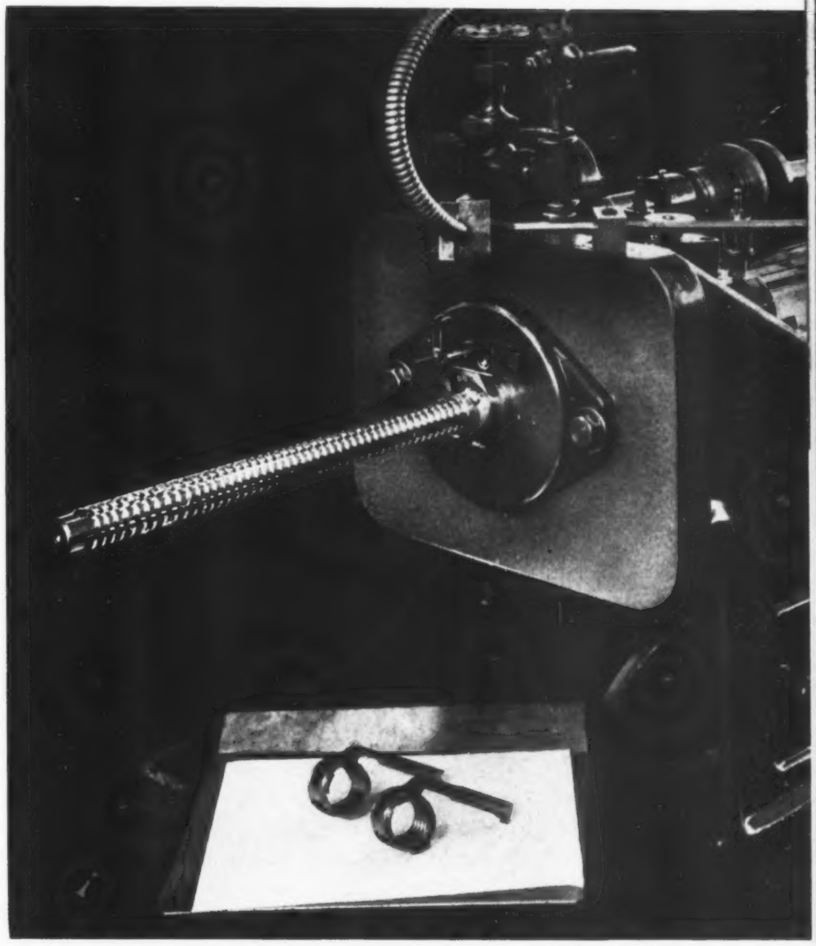


Fig. 15. (Above) Pull-broaching the Threaded Nut Barrels to Provide Interrupted Threads for Quick Locking and Unlocking

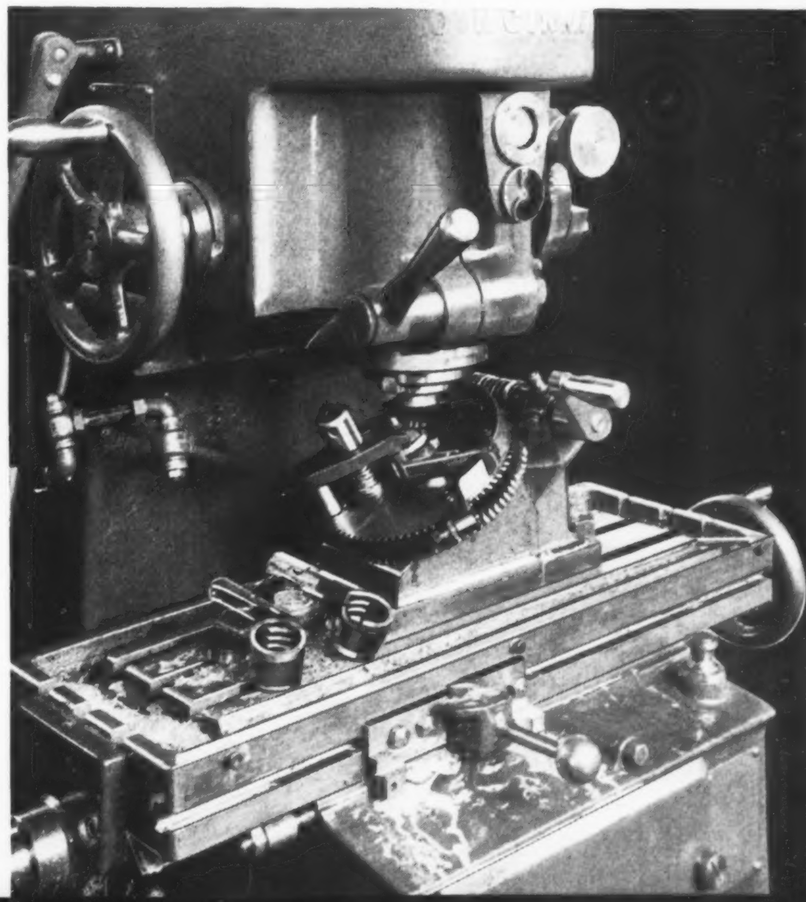


Fig. 16. (Right) Set-up Employed in Milling Part Way around the Boss on Nut Barrels at a Specified Angle

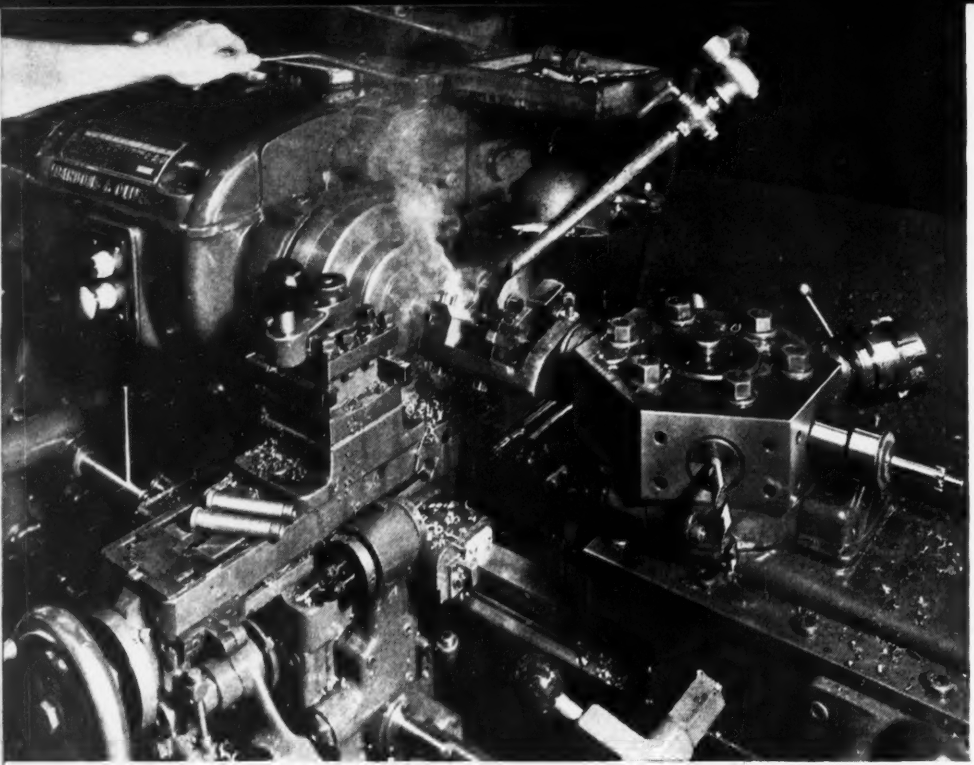


Fig. 17. Producing Piston Grip Screws at a High Rate of Production on a Turret Lathe

metal were joined. The average production is 450 magazines in eight hours.

Attention was called at the beginning of this article to the large number of gages required in manufacturing the Bren gun. A Swiss grinding machine that enables the gages to be rapidly ground within close limits is shown in Fig. 19. In the particular operation shown, a snap gage is being ground. When the desired dimension has been reached within close limits, the table of the machine is shifted to the right to bring the gage into line with a lapping wheel mounted on the same spindle as the grinding wheel. The practice is to grind the gages to within 0.0003 or 0.0004 inch of the specified size, and then to lap them within 0.0001 inch of the size without changing the setting of the work.

Suspended from an overhead bar is a unit equipped with a dial indicator graduated to 0.001 inch, and another indicator graduated to 0.00005 inch. Johansson gage-blocks are used in setting the measuring fingers of these gages. The measuring fingers are applied to the surfaces being ground or lapped by swinging down the entire indicator unit.

A machine designed especially for grinding profile gages is illustrated in Fig. 20. The gage to be ground is mounted on a table which can be adjusted longitudinally and crosswise in accordance with observations made through an optical device above the grinding wheel which magnifies the work and the wheel. A large-scale drawing of the profile to which the gage is to be ground is tacked to the table at the left, and a stylus at the end of a pantograph arm is moved along this profile a small amount at a time. The opposite end of the arm is attached to the optical device and causes this unit to swivel over the work each time the stylus is moved.

Fig. 18. The Two Pieces of Sheet Steel that Form the Magazine are Joined by Atomic Hydrogen Welding

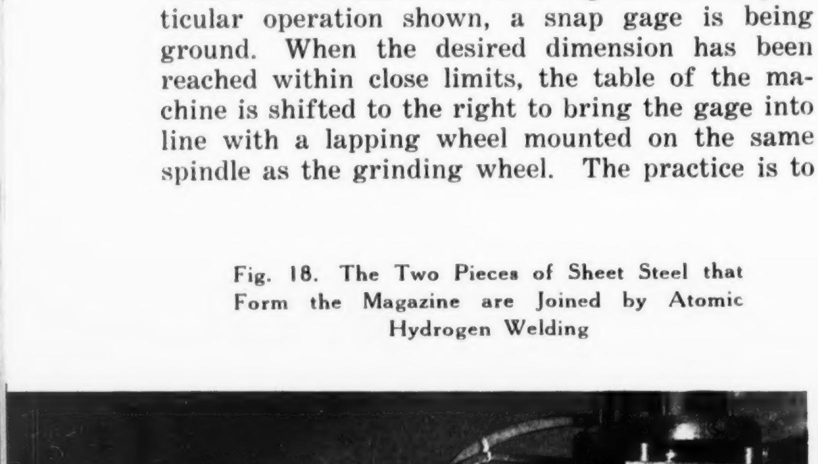
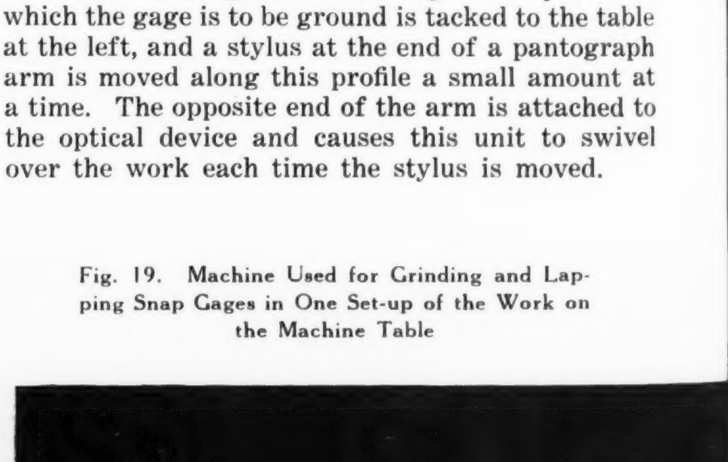


Fig. 19. Machine Used for Grinding and Lapping Snap Gages in One Set-up of the Work on the Machine Table



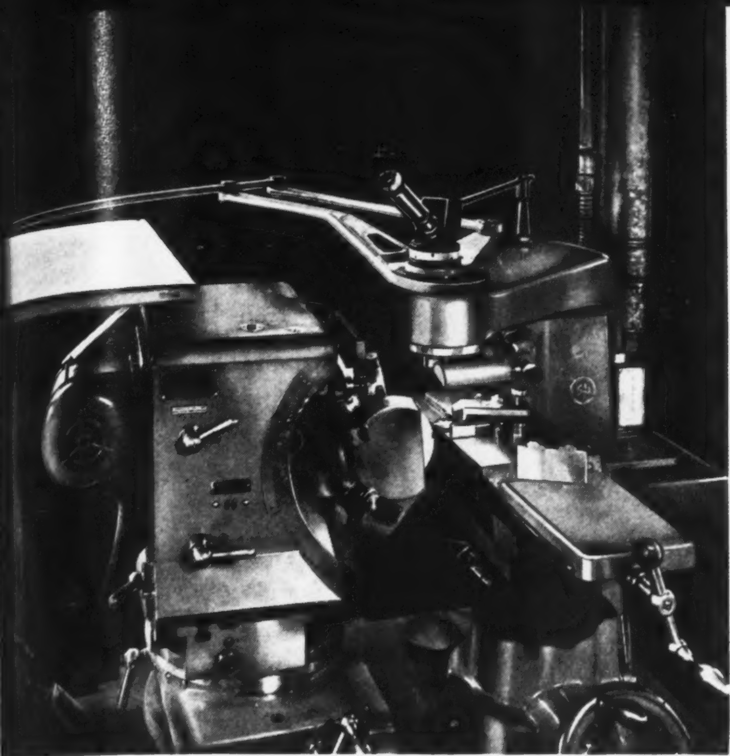


Fig. 20. An Optical Work-setting Device Insures Finishing Profile Gages According to Drawings Laid out Fifty Times Actual Size

Fig. 21. A Visual Gage, which is Graduated to Ten-millionths of an Inch, Being Used for the Inspection of Small Gages

After each adjustment of the stylus, the gage-maker observes the position of the cutter relative to the work through the optical device and makes corresponding adjustments of the table setting. He then applies the revolving wheel to the work, after which he again changes the setting of the stylus and the work until the gage has been completely ground.

At the time that the photograph was taken, the grinding wheel was set to reciprocate vertically, but it can be set to pass through any desired angular path. The particular gage shown being ground had a circular nose. On the table of the machine is a profile gage of the type for which this machine is more especially adapted. The profile drawings are usually made fifty times the actual size of the gage being ground, so that any error in the gage will be infinitesimal.

Before the gages are issued to the inspectors, most of them must undergo a rigid checking. Typical of this work is the operation shown in Fig. 21, which consists of inspecting small gage members with a Sheffield visual gage graduated to ten-millionths of an inch.

Every gun must be checked to determine its firing accuracy while mounted on a stand, as shown in Fig. 23, and discharged at a target. An inspector with a telescope observes the closeness of the bullet impact in relation to the target.

Practically all the parts that make up the Bren gun, with the exception of the wooden stock and the magazine, must be heat-treated in some manner. To provide for this, a modern heat-treating department has been installed, a general view of which is shown in Fig. 22. A great deal of the equipment in this department was supplied by the

Fig. 22. General View of the Heat-treating Department in which Practically All of the Steel Gun Components are Heat-treated in Some Manner

Fig. 23. Each Bren Gun is Checked for Firing Accuracy before being Shipped from the Factory

Leeds & Northrup Co., including two Homocarb carburizing furnaces, four Vapocarb Hump hardening furnaces, five Homo-tempering furnaces, three slow cooling pots, and Micromax temperature controllers.

The routing of the work to the hundreds of machines engaged in making the parts for the Bren gun must be closely controlled, in order to insure a smooth flow of the work and the necessary quantity of parts on hand at any time to meet the requirements of the assemblers. The plant is operated on the batch production principle; that is, a considerable number of machines are used for operations on more than one part, the tools, fixtures, and set-ups being changed periodically.

Efficient supervision of machines and operations is insured by the use of the large planning board seen in Fig. 24, which runs along a mezzanine floor of the shop. On this board there are tickets that give the scheduling for every part of the gun. Cards also record the accumulated production on any part or group of parts, and the work in process. Operations are planned for every machine at least one month ahead. Two days before a machine is to start on a new job, orders are issued by the chief planner, or one of his assistants, for the tools, gages, fixtures, material, etc., required. These orders go to tool stores, material stores, the production department concerned, and to "chasers" of the planning department.

The tool-setter of the machine to be used takes his order and places it in a box attached to the machine, which holds orders of jobs that are coming up. There is another box on each machine in which the order is placed that covers the operation being performed. In this way, the machine operator is always apprised ahead of time of contemplated change-overs.

The blueprints issued to the machine operators for each job have been so simplified as to show practically only the surfaces to be machined and the dimensions pertaining to those surfaces. In other words, all dimensions and views extraneous to the particular operation to be performed are eliminated. Blueprints of this type are especially satisfactory in cases where the machines are operated by girls or men who have had little or no previous mechanical training.

* * *

The pronounced activity in the aircraft industry is bringing about increased use of high-strength, low-alloy, heat-treated steels for structural aircraft parts, including the tubing for engine mounts and landing gears; propeller blades, shafts and hubs; connecting-rods, etc. The automotive and aviation industries are also using more nickel-chromium-molybdenum steel for highly stressed parts. These steels are often machined after heat-treatment to 450 Brinell. Such machining, once considered impracticable, is now being done by modern cutting tools without difficulty.

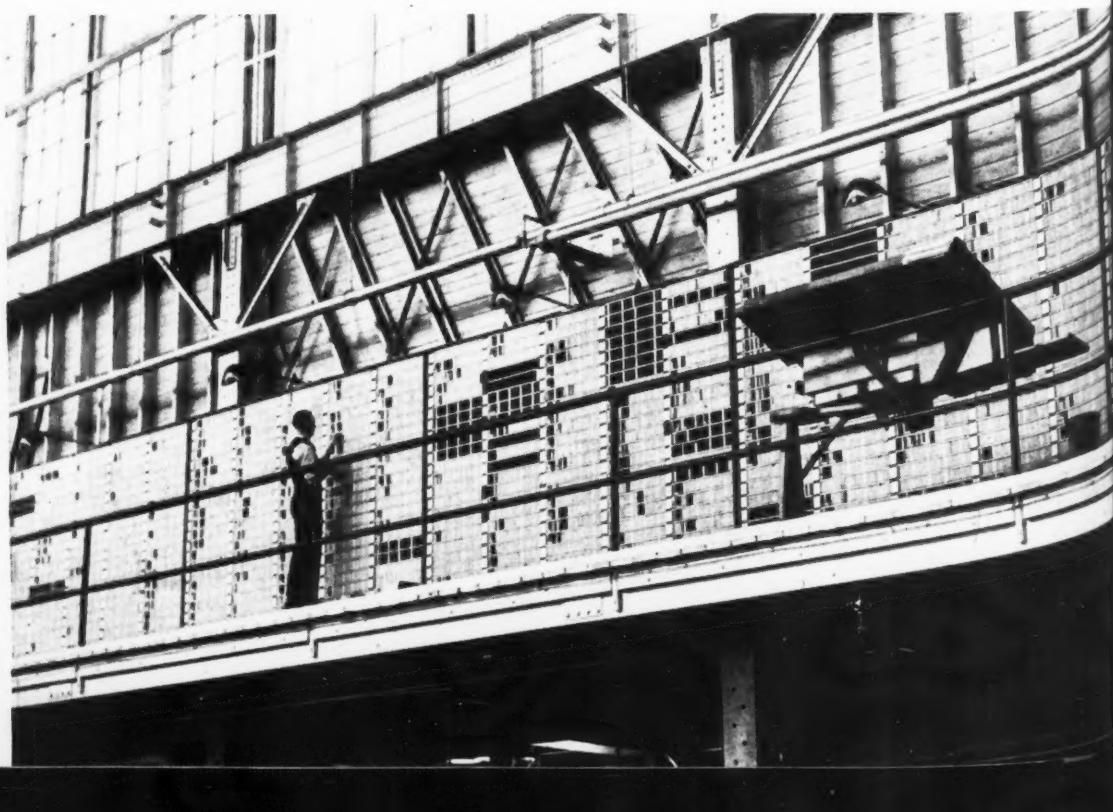
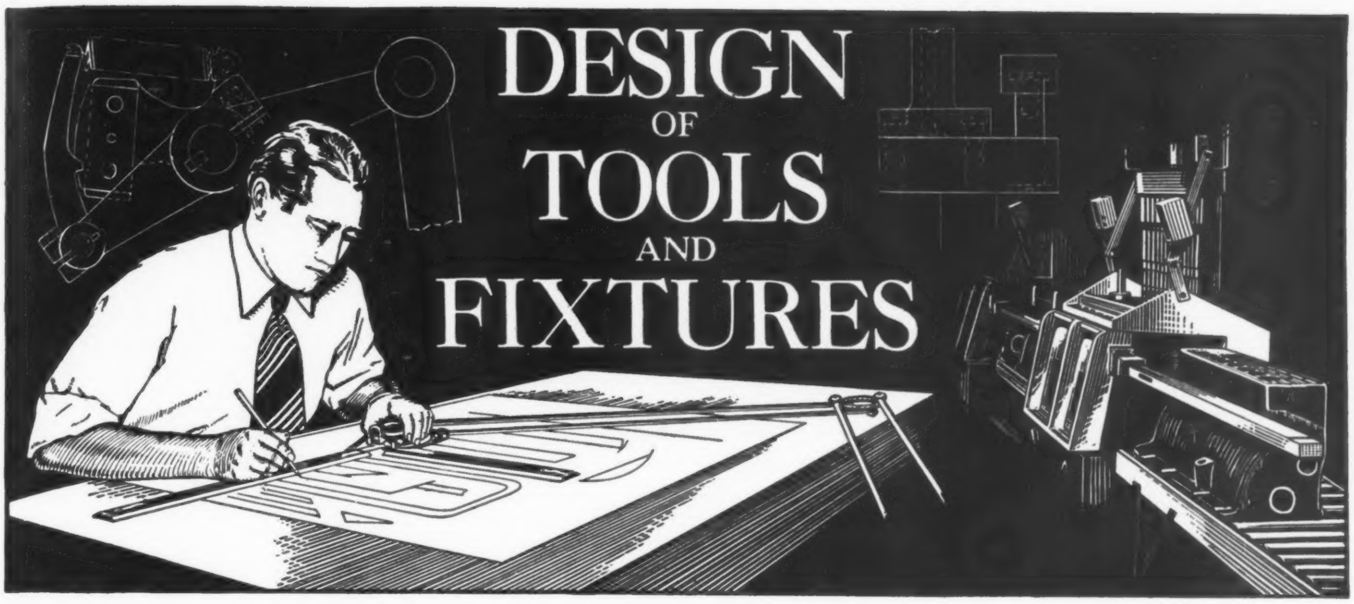


Fig. 24. The More than 2800 Operations Involved in the Production of Bren Machine Guns are Closely Controlled from This Production Board on a Mezzanine Extending along One Side of the Shop

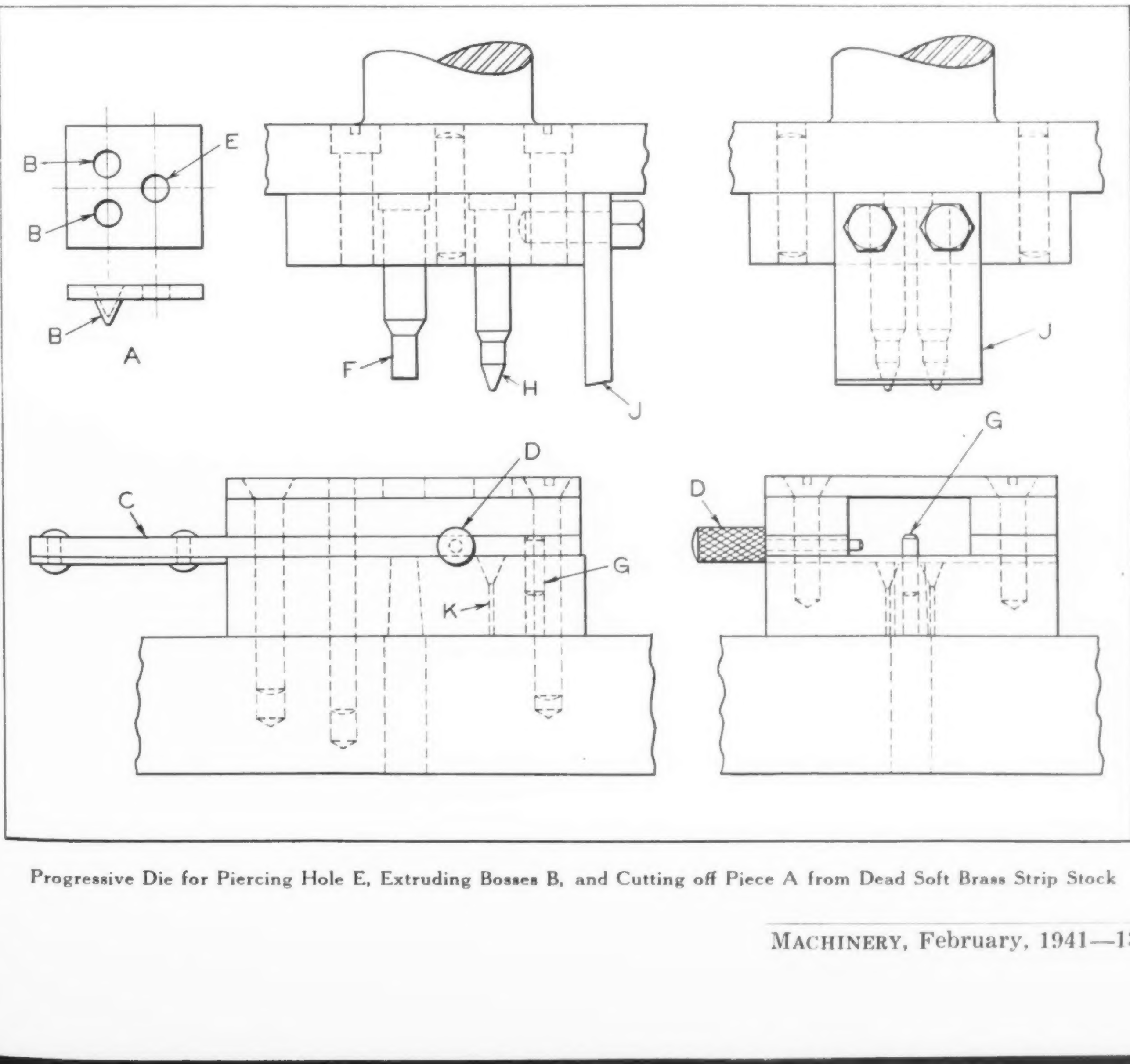
HOW CANADA MAKES MUNITIONS



Die for Extruding Cone-Shaped Bosses

By GEORGE WILSON, Mankato, Minn.

It was thought at first that two extruding operations would be required to raise the cone-shaped bosses *B* on the brass piece shown at *A* in the accompanying illustration. Accordingly, the punches for the first stage were made blunt, being designed to raise the cones about half their required height. However, it was found, through experimentation, that the cones could be raised to the full height in a single stroke of the press, and the first stage of the die was, therefore, subsequently eliminated.



Progressive Die for Piercing Hole E, Extruding Bosses B, and Cutting off Piece A from Dead Soft Brass Strip Stock

The die is of the progressive type in which the stock is fed through guide C against the temporary stop-pin D, which is pushed in to engage the end of the stock. In this position, hole E is pierced by punch F. Pin D is then withdrawn and the stock is moved ahead until hole E drops over the permanent stop-pin G. The stock is then held against pin G in the usual manner while punches H extrude the cones and shear J cuts off the piece previously pierced and extruded. If the cone-forming punches are brought down too far, a core of metal will be extruded into vent-hole K. The stock used for part A is dead soft brass. If an attempt were made to use harder material, the extruded cones would be pushed off or would break away from the work. Sufficient space is provided between the stripper plate and die to clear the extruded cones.

Drill Jig with Magazine Feed

By JOSEPH WAITKUS, Wellsville, N. Y.

The attention given motion studies and their effect on production has resulted in the development of many special jigs and fixtures of interesting design. Such equipment not only serves the purpose of facilitating the production of an accurate and uniform product, but is also intended to reduce to a minimum the work required of the operator.

A typical example of this type of design is the drill jig here illustrated. The work is shown in Fig. 1. It is a U-shaped stainless steel strip with three holes W drilled through both legs. The interesting features of the jig are the adaptation of a magazine for stacking the product to be drilled, and an automatic ejecting device for the finished product.

The drill jig consists of a cast base A, to which the magazine rails B are fastened. A bushing bar D is fastened to base A. Three drill bushings G are provided in the bushing bar.

The feeder consists of fingers H, fastened to a bar J, with a handle O. Guide rods L, fastened to bar J by set-screws M, pass through bearing blocks N, which are a part of base A. One end of the guide rods is tapered sharply and is provided with a stop-lug Q for limiting the outward movement of fingers H.

The ejecting device consists of three plates R, hinged by pins S to the bearing blocks N. Pins S are secured to the bearing blocks by small pins T. The U-shaped strips are stacked between the magazine rails B, as shown in Fig. 3, the entire stack resting on the bearing blocks N. Fingers H are clear of the U-strip, and the ejecting plates R are shown resting on the bottom of base A.

In Fig. 4, fingers H are shown pushed forward

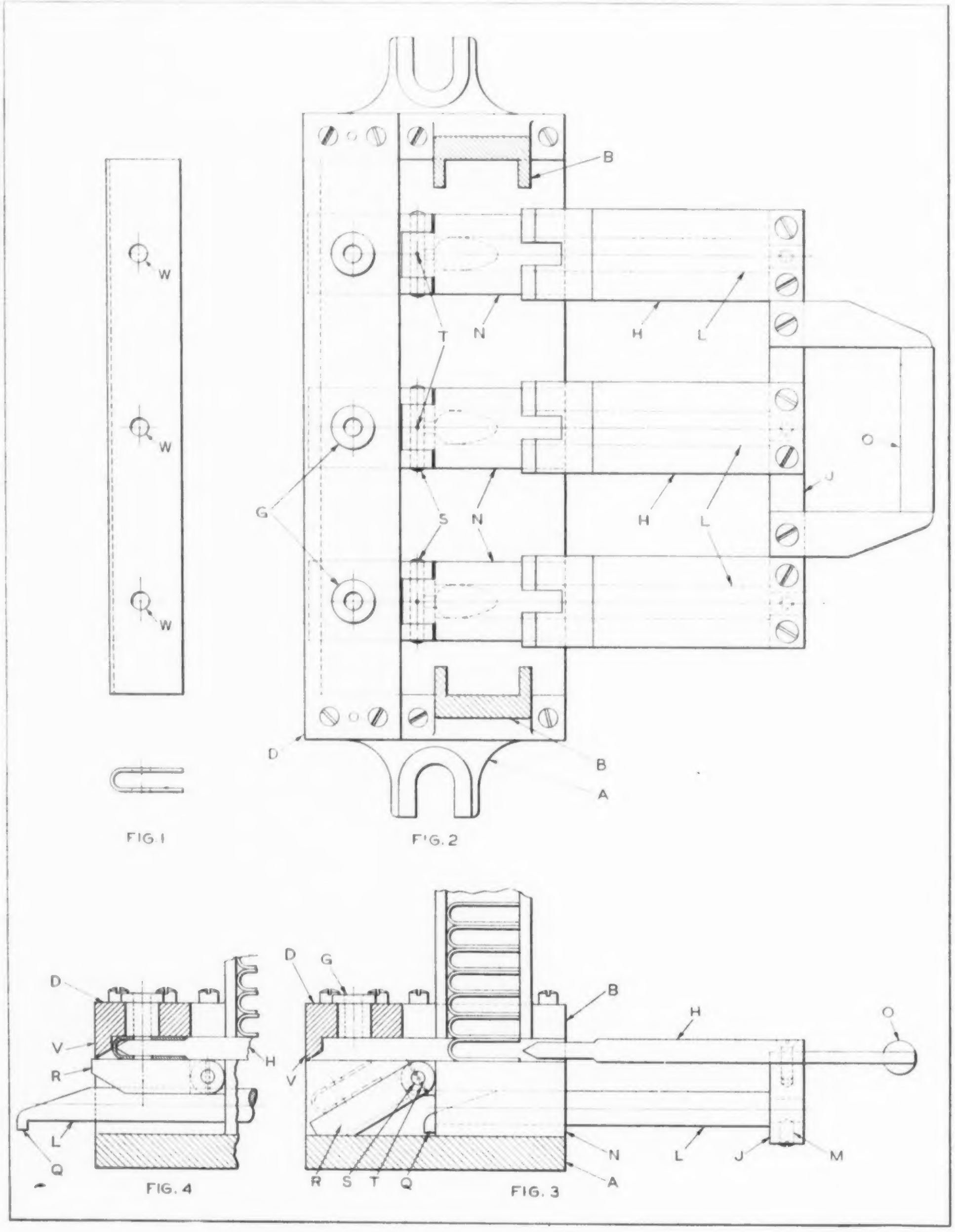


Fig. 1. U-shaped Piece with Three Drilled Holes. Fig. 2. Plan View of Magazine-fed Jig Used in Drilling Three Holes W in Piece Shown in Fig. 1. Figs. 3 and 4. Views Illustrating Operation of Work-feeding Device

into the bottom U-strip, which is thus removed from the stack and forced against the stop-edge *V* on bushing bar *D*. When fingers *H* move forward, the guide rods *L* also move forward, causing stops *Q* to strike the ejecting plates *R* and raise them until they come to rest against stop-edge *V*. This completes the feeding operation that carries the U-strip into place ready for the drilling operation. When the drilling is completed, fingers *H* are withdrawn, and, at the same time, rods *L* are removed from under ejecting plates *R*, causing them to drop to the position shown in Fig. 3. The U-strip then drops out and slides into a receptacle.

In order to avoid trouble from chips, the stop-edge *V* is beveled, as shown, so as to provide a space into which any such waste matter can be forced, leaving the U-strip resting against clear surfaces. The lower face of ejecting plate *R* is slightly lower than the upper edge of the bore provided for rods *L*. When the hole is machined in the bearing blocks *N*, it is continued through so as to provide a slight groove in the ejecting plates *R*. This insures accurate alignment of the surfaces in contact with guide rods *L* and uniform distribution of the load on the three rods.

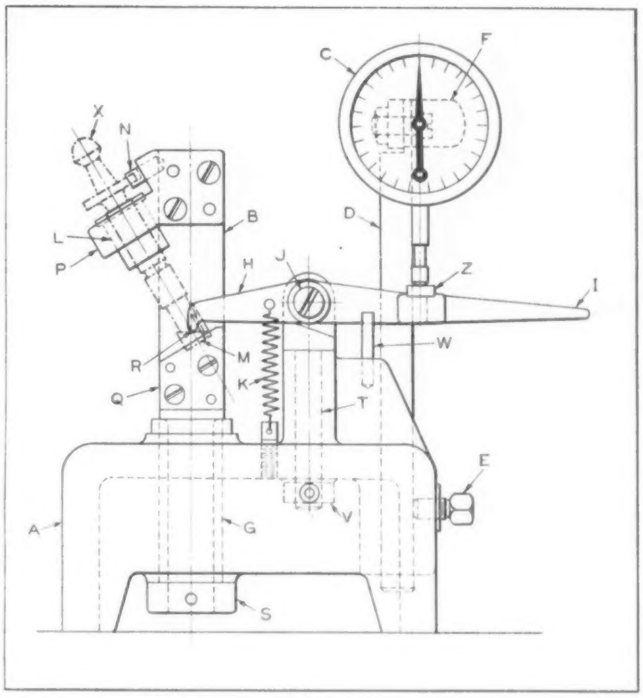
In order to prevent the U-strip from adhering to fingers *H* when they are withdrawn, the fingers are made slightly thinner than the inside dimension of the U-strip. At the same time, the space between bushing bar *D* and ejecting plates *R* is made a little less deep than the thickness of the U-strip. This causes the U-strip to remain in place and permits easy removal of fingers *H*.

Fixture for Angular Surface Test Indicator

By F. SERVER

The curved and angular surface *R* machined on the lower portion of the small spindle *X* shown in the accompanying illustration must be accurately positioned with respect to the distance from the end *M* of the spindle. The fixture used in testing this surface holds piece *X* in the same position in which it was held while surface *R* was being milled. With piece *X* held in this manner, dial indicator *C* is employed to check the position of surface *R*.

The base of the fixture is indicated at *A*. Work *X* is mounted on a rotatable unit *B*, constructed in the form of a spindle which is cut back so that the center line of work *X* is on the same center as the spindle. Dial indicator *C* is supported on base *A* by a stem *D*, clamped in place by screw *E*; there is a small bracket *F* at the rear of the indicator for attaching it to the stem. Resting on the work at *R* is a lever *H* that pivots on stud *J*. Spring *K* normally holds the lever against the work. The end of lever *H*, however, can be raised, to permit the work to be placed in the fixture, by simply pressing down on the outer end *I*.



Fixture for Testing Location of Surface R with Respect to End Surface M

Work *X* is inserted through bushing *L*, the lower end entering a counterbored spot at *M*, which serves to center the work. Two pins at *N*, one of which is directly behind the other, provide means for locating the work radially by a lug which passes between the pins. Bushing *L* is carried in a bearing *P*, attached to the revolving unit *B*, while a block at *Q*, attached to *B*, serves to center the work. Part *B* is cut back, as mentioned, to provide clearance for the work, and has a turned portion at its lower end that is free to revolve in bushing *G*. The collar at *S* keeps the entire revolvable unit in place.

Lever *H* is raised to clear the work when it is being located in the fixture. It is possible to swing the gaging end of the lever forward, as it is held by stud *J* on a shouldered post *T*, which is free to revolve in the base of the fixture and is retained by collar *V*. There is a stop-pin at *W* which controls the sidewise swinging movement of the gaging lever. Lever *H* is provided with a hardened plug *Z* against which the gaging point of indicator *C* rests.

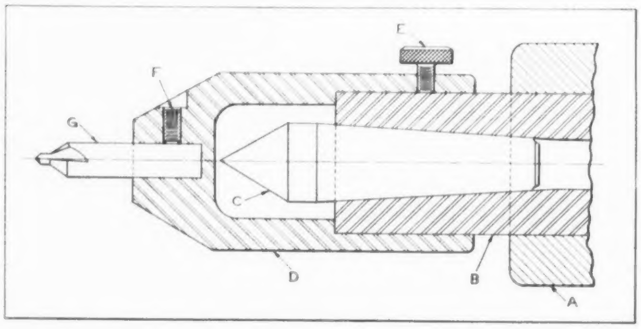
In gaging work, the operator slips piece *X* in place with his left hand while holding end *I* of lever *H* down and revolving the lever to clear the work. Spring *K* is then allowed to pull the gaging end of the lever over the work into the position shown, with the measuring stem of the dial indicator resting on block *Z*. A plus or minus reading is then taken on the dial to determine if the cam surface of the work at *R* is within the desired limit. By revolving the entire unit *B*, the full length of the cam surface can be gaged along the path of the milled cut to determine its distance from the lower end *M* of the work.

Lathe Tail-Spindle and Center-Drill Holder

By W. M. HALLIDAY, Leeds, England

While the center-drill holding device described on page 118 of August, 1940, MACHINERY is a useful accessory for the lathe, it has several disadvantages not found in a holder that the writer has used for a long time.

In the writer's opinion, the holder referred to has the following disadvantages. Referring to the illustration in August MACHINERY, the tail-center *B* does not project a sufficient amount from the tail-spindle *C* to provide adequate bearing length for the center-drill holder *A;* as the projecting portion of the center *B* is likely to become bruised on the exterior surface due to rough handling, the fit of the No. 4 Morse taper end will be impaired unless the drill-holder is kept constantly in place; errors in alignment of the center drill with the axis of the spindle are likely to occur, because accuracy depends upon the fit of too many surfaces, namely the fit of the tail-center in the spindle, the fit of the holder on the end of the center bit, and the fit of the spindle in the tailstock itself; holder *A* can be forced tightly on center *B*, and may eventually cause center *B* to leave the spindle rather than the holder, in which case difficulty will be experienced in withdrawing the holder from the center.



Lathe Tail-spindle and Holder for Center Drill

The construction of the device that the writer is using is shown in the accompanying illustration. This type of auxiliary drill-holder is capable of very accurate work. Ease of handling, minimum time required for changing over or setting up, and elimination of the necessity for making alterations in standard type centers are all advantages of this holder.

The cylindrical, hardened cast-steel holder *D* for the center drill is bored out for the greater portion of its length, approximately half the total length of the bored hole being enlarged to a close push fit over the tailstock spindle *B*. The accurate concentric shoulder at the end of the tail-spindle takes the thrust when the center drill is cutting. The smaller bore is large enough to clear the center *C*. The brass knurled locking screw *E* serves to secure the holder sleeve *D* without raising burrs. The forward end of holder *D* is beveled as shown.

The center drill *G* is carried in the blind, concentric bore hole at the front end of holder *D*, and is held in position by the socket-head screw *F*. It is advisable to grind a flat on the shank of drill *G* to provide a good bearing for the end of screw *F* and thus prevent the drill from turning when cutting. The square end of the drill, which takes the thrust, should bear directly on the bottom of the holder.

Removal of this form of auxiliary holder is extremely simple, as it is unnecessary to make it a forced fit on a taper or over the tail-spindle. Thus pry bars or lead hammers need not be employed for removing the auxiliary holder. The bearing length, with this arrangement, is increased, and the overhang distance of the center drill from the spindle end is much shorter. These features tend to enhance the accuracy and rigidity of the tool.

* * *

Society of Tool Engineers Plans Program for Annual Meeting

The annual meeting of the American Society of Tool Engineers, to be held in Detroit, Mich., March 25 to 29, will be concerned largely with the National Defense Program. The meeting will have sessions each day, and will include addresses by Army, Navy, and Aircraft officers, and executives and engineers of industry. Concurrent with the annual meeting, the Machine Tool and Progress Exhibition sponsored by the Society, will be held in Convention Hall, Detroit.

Monday afternoon, March 24, there will be a preview of the exhibition for invited guests only, followed by a dinner for officials of industry and of the Government. Immediately following the dinner, a representative of the U. S. Army will speak on "What is Needed for National Defense."

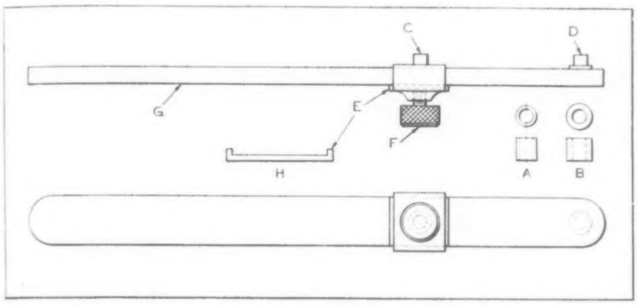
On Tuesday, March 25, which will be designated Aeronautical Day, papers on tooling for aircraft engine and fuselage production will be presented. On Wednesday — Navy Day — addresses relating specifically to problems of this branch of the Defense Program will be given. Thursday there will be three addresses, each bearing directly on education for defense; the problem of the shortage of skilled men will also be dealt with at this session. The annual dinner of the Society will be held Friday evening, when the principal speaker will discuss the subject "Expediting National Defense."

* * *

If we can learn nothing else from Europe, two lessons are plain: First, the peoples who do not hang together, hang separately; and, second, factory production is of first importance in preparedness. — *James S. Knowlson, president, Stewart-Warner Corporation.*

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



Adjustable Spanner Wrench and Adapter Bushings

Adjustable Spanner Wrench

The accompanying illustration of an adjustable spanner wrench is practically self-explanatory. Casehardened bushings, such as shown at *A* and *B*, are made in pairs to be slipped over the spanner pins *C* and *D* to adapt them for spanner wrench holes of different sizes. The gib *E*, designed to prevent the adjusting screw *F* from marring the frame *G*, is shown to an enlarged scale in the view at *H*.

Denver, Colo. EVERETT McDONALD

Eliminating Failure of Countersunk-Head Rivets

Flat-head rivets, 3/8 inch in diameter, which were being set by the cold-squeezing method regularly failed at a fraction of the normal load through the "popping" off of the countersunk heads. Efforts to correct this trouble, including changes in the composition and heat-treatment of the rivet steel, were without result until the fundamental principles were investigated. The rivet that failed and the manner in which it was being used are shown at *A* and *B*, Fig. 1.

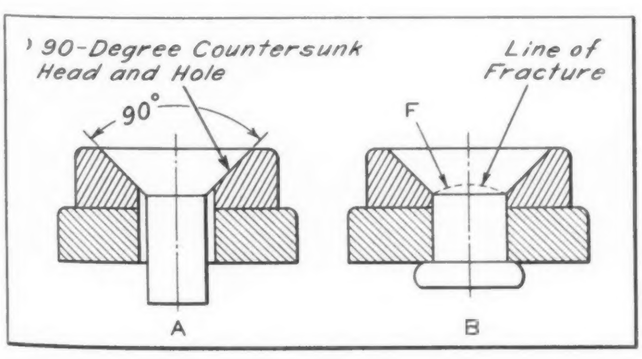


Fig. 1. (A) Rivet which Failed after Riveting, as Indicated at B

It was reasoned, and demonstrated by experiments, that the squeezing of an unconfined rivet resulted in expansion of the body and smaller portion of the countersunk head, accompanied by the partial forcing of the body into the head, causing a shear fracture at the neck, as indicated by the dotted line at *F*. It was also reasoned that when, in the actual process of riveting, the countersunk head was closely confined in the countersink, the expansion of the body in filling up the straight portion of the hole would result in an abrupt shearing distortion of the metal at the neck of the rivet. To correct these faults, three changes were made, which resulted in the elimination of failures.

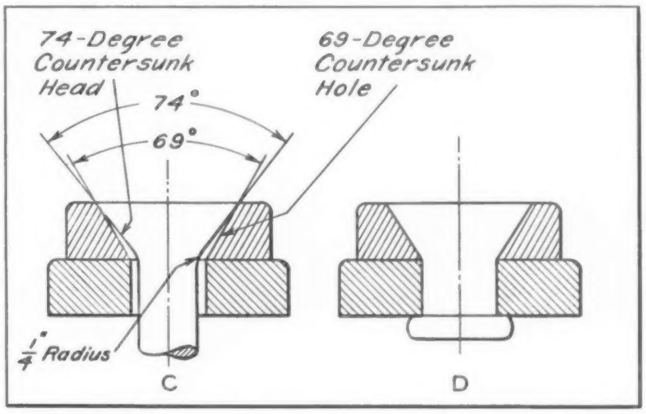


Fig. 2. (C) Rivet Head and Countersunk Hole as Modified to Eliminate Failure. (D) Rivet Shown at C after Riveting Operation

The first step was to change the angle of the rivet head from 90 to 74 degrees, thus reducing the possibility of shear fractures at the neck of the rivet when the body was forced into the head. The second step was to provide a 1/4-inch radius fillet at the neck of the rivet. The third step was to provide space in the countersunk hole to permit the smaller portion of the countersunk head to expand with the body. This was accomplished by making the included angle of the countersunk hole five degrees less than the included angle of the rivet head, as indicated at *C*, Fig. 2. This permitted the smaller portion of the countersunk head to expand the same amount as the rivet body and fill the body hole and countersunk portions of the riveted material, as shown at *D*, Fig. 2.

Richmond, Ind. ROBERT SPURGIN, JR.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Welding Alloy Steel to Carbon Steel

E. K.—Is it practicable to arc-weld SAE 3140 steel to SAE 1045 steel? We would like to weld a high-strength alloy-steel eye to the end of a carbon-steel screw that is 5 3/4 inches in diameter. What type of welding rod would be recommended for a job of this kind?

Answered by Editor, "Nickel Steel Topics"
International Nickel Co., Inc., New York City

While a steel such as SAE 3140 requires special handling, it is readily weldable if the proper technique is used. The SAE 1045 carbon steel may also offer some difficulties if certain precautions are not observed during the welding operation. If you preheat both steels to approximately 500 degrees F., you should have no difficulty in welding. Preheating may be applied locally. However, after welding it will be necessary to stress-relieve the weld at a temperature of from 1100 to 1150 degrees F. to prevent distortion and brittleness. This also may be done locally.

If the SAE 3140 forging is to be used in the heat-treated condition, the material adjacent to the weld will have lower strength properties than the remaining section of the forging which has not been affected by the heating.

Are Contracts Relating to Subsequent Employment of Employes Valid?

I. M.—Is a contract valid by the terms of which an employe agrees not to enter into a competing business, or take employment with a competitor, within a year or so after leaving his present employer?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Yes, the contract is valid in many states, provided the time during which the employe will not compete is not over two years and the territory is no greater than that in which the employer regularly does business; furthermore, the employe must not be an ordinary laborer, but a salesman, executive, or clerk who possesses confidential information regarding the business. If the employer breaks the employment contract, then the employe may accept employment immediately with a competitor without regard to the obligations he assumed under the employment contract.

For illustration, in Langdon v. Progress Co. [105 S.W. (2d) 346], a company and an employe entered into a contract by the terms of which the employe agreed not to accept employment with a competitor within a year after terminating employment with the company. Later the company reduced the employe's salary agreed upon in the contract. After complaining of the reduced income, the employe left the service of the company and immediately entered the service of a competing company. The former employer filed suit to prevent the employe from working for the competitor. In refusing to prevent the employe from remaining in the new employment, the higher Court said: "Appellee (company) having wrongfully breached the contract... cannot go into a court to secure, by injunction, the enforcement of another provision of the contract favorable to it."

* * *

Exports of Industrial Machinery Continue to Increase

The United States exports of industrial machinery in November—the last month for which complete reports are available—established a new record for the second successive month, with total shipments amounting to $45,252,000, compared with $43,567,000 in October. According to the Machinery Division of the Department of Commerce, Washington, D. C., the total value of power-driven metal-working machinery exported during November rose to $27,414,000—2 per cent above the shipments in October. Of the different types of machine tools, shipments amounting to $6,053,000 represented milling machines; $1,657,000, drilling machines; $5,891,000, engine, automatic, and turret lathes; and $3,943,000, grinding machines.

The machine tool exports to England amounted to $19,218,000; the October value was $19,903,000. The shipments to England accounted for 77 per cent of the total machine tool exports. The exports to Japan dropped from $1,393,000 in October to $478,000 in November. The shipments to the Soviet Union amounted to $1,025,000, and to Canada, $2,615,000. The shipments of machine tools to all of Latin America were valued at $199,000. Compared to the total exports, it will be noted that the South American machine tool trade is very small.

Arc-Welding Tubular Shapes

By G. G. LANDIS, Chief Engineer
The Lincoln Electric Co., Cleveland, Ohio

A TUBULAR section is the most satisfactory structural member to use when a large amount of torsion is involved. It is for this reason that airplane fuselages are constructed chiefly of tubular shapes. Bedplates, likewise, may be subjected to extreme torsion, and in such cases, it may be advisable to use tubular bracing or even main members of tubular shape to resist the torsion. Typical applications are illustrated in Figs. 1 and 2. Welding has made the increasing use of tubular sections possible because it permits such sections to be connected to other members without the use of a mechanical connecting member. Welded connections can be made between tubular shapes, or between tubular and structural shapes, at any angle.

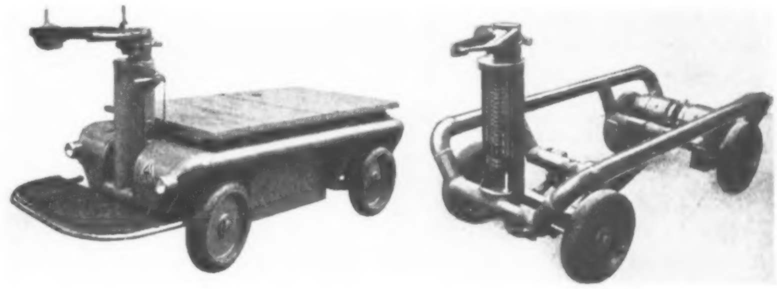


Fig. 1. Small Electric Truck with Welded Tubular Frame

The simplest connection is a straight end-to-end butt connection of the same size tubular shapes. This may be a plain butt joint (Fig. 3) or a butt joint with a back-up ring (Fig. 4). The backing is of great assistance in assembly and may permit higher welding speeds. The abutting ends may be straight or scarfed, depending upon the thickness of the tube wall.

When one tube must be connected to another at an angle, the connection can be designed in several ways. The end of one tube may be cut to fit a curved surface on the second member, as shown in Fig. 5, or a hole may be cut in the wall of one member to allow the other member to be inserted (Fig. 6). This hole should be of such shape as to permit a close fit with the inserted member at the desired angle. Both types of joints require a fillet weld. One advantage offered by the type of connection shown in Fig. 6 is that in the assembly of several members, simpler jigs or fixtures may be used to hold the assembly in alignment for welding, due to the adjustment possible because of the slip joint.

When it is desired to join the ends of two tubular members other than at a straight angle, any one of several types of joints may be used. The joint shown in Fig. 7 is the simplest of this type, the ends of both members being mitered to the desired angle to form a butt joint for welding. The sharp corner shown in Fig. 7 may be eliminated by the use of one or more additional members. Fig. 8 shows the use of one additional member which requires two welded joints. Improved appearance may be obtained by the use of a special fitting which requires two plain butt-welded joints, as shown in Fig. 9.

These designs and connections of tubular members in the same plane are basic; many variations are possible. In designing connections, consideration should be given not only to appearance, but also to the amount of cutting and welding required.

A comparison of tubular shapes and H-beams will be made first on the basis of equal area or weight per foot, taking as an example the H-beams shown in Table 1 (see page 144).

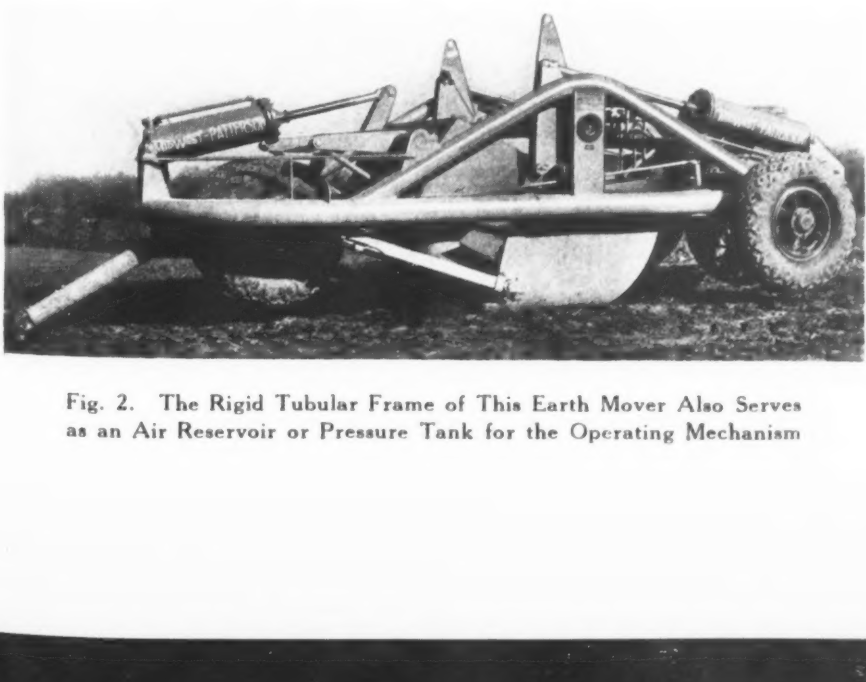


Fig. 2. The Rigid Tubular Frame of This Earth Mover Also Serves as an Air Reservoir or Pressure Tank for the Operating Mechanism

The moment of inertia is a measure of the deflection. The minimum moment of inertia is only about one-third the maximum.

For the same area or weight per foot, the moments of inertia for 4-, 5-, 6-, and 8-inch diameter pipes which would have the same over-all dimensions as the H-beams (although not occupying the space as economically as the H-beams), are given in Table 2. They are approximately twice the minimum moments of inertia, and approximately 70 per

Table 1. H-Beams

Size, Inches	Weight, Pounds per Foot	Area, Square Inches	Moment of Inertia	
			Max.	Min.
4 by 4	13.8	3.99	10.7	3.6
5 by 5	18.9	5.47	23.8	7.8
6 by 6	22.5	6.66	41.0	12.2
8 by 8	34.3	10.00	115.5	35.1

cent of the maximum moments of inertia of the H-beams. It is also to be noted that this moment of inertia applies to all directions, and therefore the pipe can be loaded in any direction desired.

If the thickness of the pipe is increased so as to obtain the same moment of inertia for the pipe as the maximum moment of inertia of the H-beam, as indicated in Table 3, there is a considerable increase in weight for a given deflection. Up to this point, only the straight loading or the beam loading of this particular type of structure has been considered.

Obviously, the use of a pipe would not be economical where it was just a plain case of bending in a single plane; but where it is a case of torsion—that is, twisting—or of combined twisting and bending, the pipe is more economical. It would take a rather involved mathematical demonstration to show the characteristics of the tube in torsion; but it is obvious that the metal is displaced all around the center point, which is the center line or axis of the tube, and, therefore, is distributed to the best possible advantage; whereas, in the case of the H-beam, it is not so distributed, and for pure torsion it would not, therefore, act so effectively.

To summarize: A pipe is the best structural member for use when there is combined bending and torsion or just pure torsion. It is also obvious that a pipe, for the same weight, is superior to an H-beam, if the minimum moment of inertia of the H-beam is considered. It is also obvious that an H-beam represents the most economical distribution of metal for direct loading or bending, whereas a pipe represents the most economical distribution of metal under torsion. It should be noted, however,

Table 2. Pipe of Same Over-all Dimensions and Weight per Foot as H-Beams in Table 1

Diameter, Inches	Wall Thickness, Inches	Moment of Inertia
4	0.36	6.8
5	0.38	15.0
6	0.38	27.0
8	0.41	72.5

that the pipe is more economical for torsion *and* bending than the H-beam, and the more the torsion predominates, the more the superiority will be in evidence.

In the case of columns, the deflection for a given

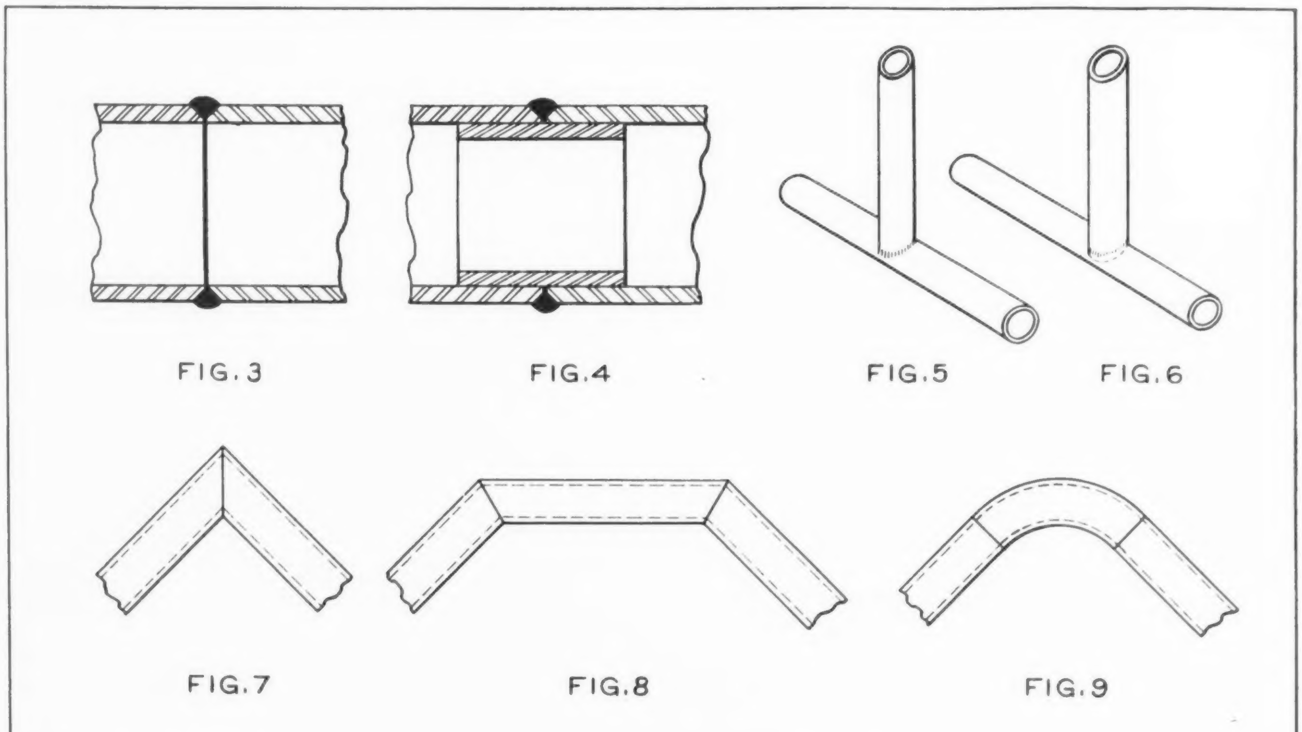


Fig. 3. Plain Butt Joint. Fig. 4. Butt Joint with Back-up Ring. Fig. 5. End of One Tube Cut to Fit a Curved Surface on the Other Member for an Angle Connection. Fig. 6. Hole Cut in the Wall of One Member to Permit Insertion of the Other for an Angle Connection. Fig. 7. The Ends of Two Members Mitered to the Required Angle to Form a Butt Joint. Fig. 8. By Making the Joint in Fig. 7 from Three Members, Two Welded Joints will be Required, but a Sharp Corner is Avoided. Fig. 9. Improved Appearance Obtained by Using a Special Fitting Requiring Two Plain Butt-welded Joints

Table 3. Pipes Having Moments of Inertia Equal to Maximum Values for H-Beams, Table 1

Diameter, Inches	Wall Thickness, Inches	Moment of Inertia
4	0.73	10.7
5	0.76	23.8
6	0.67	41.0
8	0.75	115.5

load is dependent upon the slenderness ratio $l:r$, l representing the unsupported length of the compression or column member, and r the radius of gyration. Owing to the symmetry of a tubular shape, r has a single value, whereas in the case of H- or I-shapes, this is not true. Therefore, when considering the latter shapes, the smallest value of r that will meet the requirements must be used in the calculations; that is, the minimum strength value must be used.

* * *

All Defense Projects are Not Being Delayed

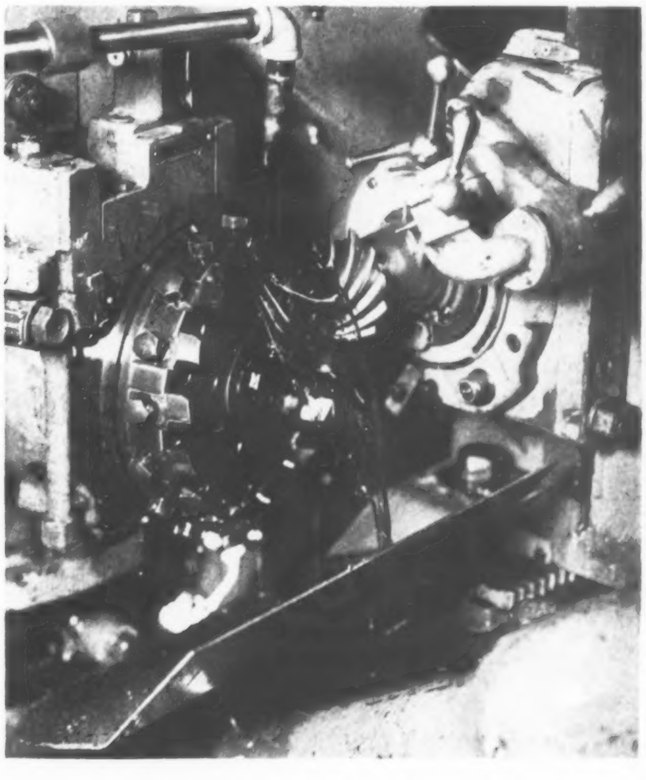
At a time when there has been so much talk of delays in defense production, it is of especial interest to record that the American Car & Foundry Co., Berwick, Pa., delivered its first tank to the Government sixteen days prior to the contract requirements, and completed delivery of the entire first order of 329 tanks in December, 1940, although the contract called for completion by January 11, 1941. The company is now engaged in building an additional and much larger order. At a meeting held by the New York Railroad Club in the main auditorium of the Engineering Societies Building, New York City, Frederick A. Stevenson, vice-president for operations of the American Car & Foundry Co., touched on some of the many problems that arose in the course of the manufacture of these tanks, each of which is composed of 14,318 individual pieces, exclusive of the engine and accessories.

* * *

Tax Laws Prevent Business from Preparing for a Decline

In a recent address, James S. Knowlson, president of Stewart-Warner Corporation, said: "As business sweeps up and we have more book business, more profits, and our stockholders and our banker friends congratulate us on our work, we are all of us going to be inclined to feel that it must be something in us personally that has accomplished these results, rather than the swing of the pendulum. The situation is particularly dangerous today, as compared with days gone by, because in the old days, in times of good business, we were able to lay up large reserves in cash and securities, which were sufficient to carry us through at least the initial part of the downward swing and give us time to readjust ourselves." [Present tax laws make it practically impossible for business to build up a reserve for a rainy day.]

The Photograph from which This Illustration was Reproduced was Made at the Pontiac Automobile Plant by a New High-speed Photolight in the 30,000th Part of a Second. It Shows a Bevel-gear Generator, Running at Full Speed, as if it were Standing Still. Note How the Cutting Oil, which, to the Naked Eye, Appears to Cover the Entire Gear and Cutter Teeth, Looks Like a Solid Plastic Sheet to the Lens



Pumps for the

Manufacturing Operations in a Well-Known Plant on the Pacific Coast that has been Building Oil-Well Pumps to

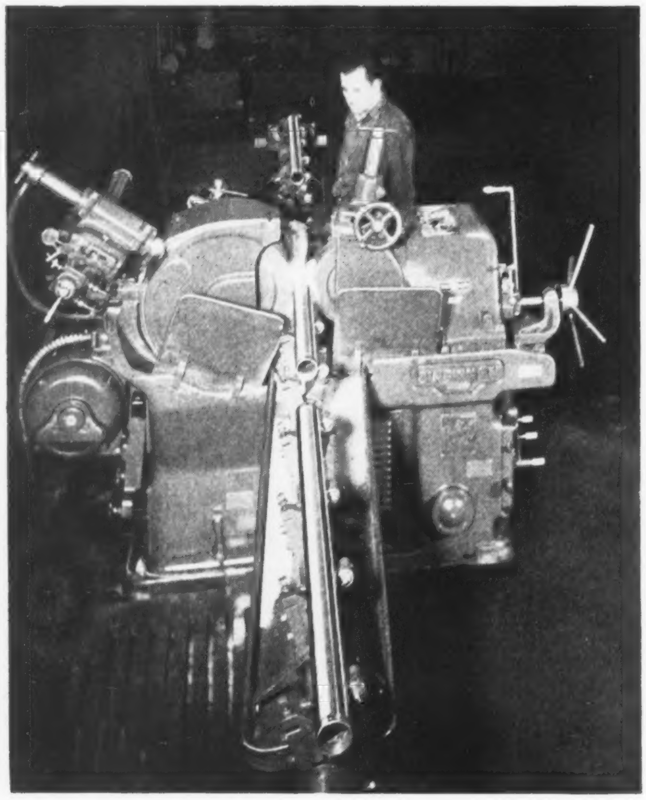
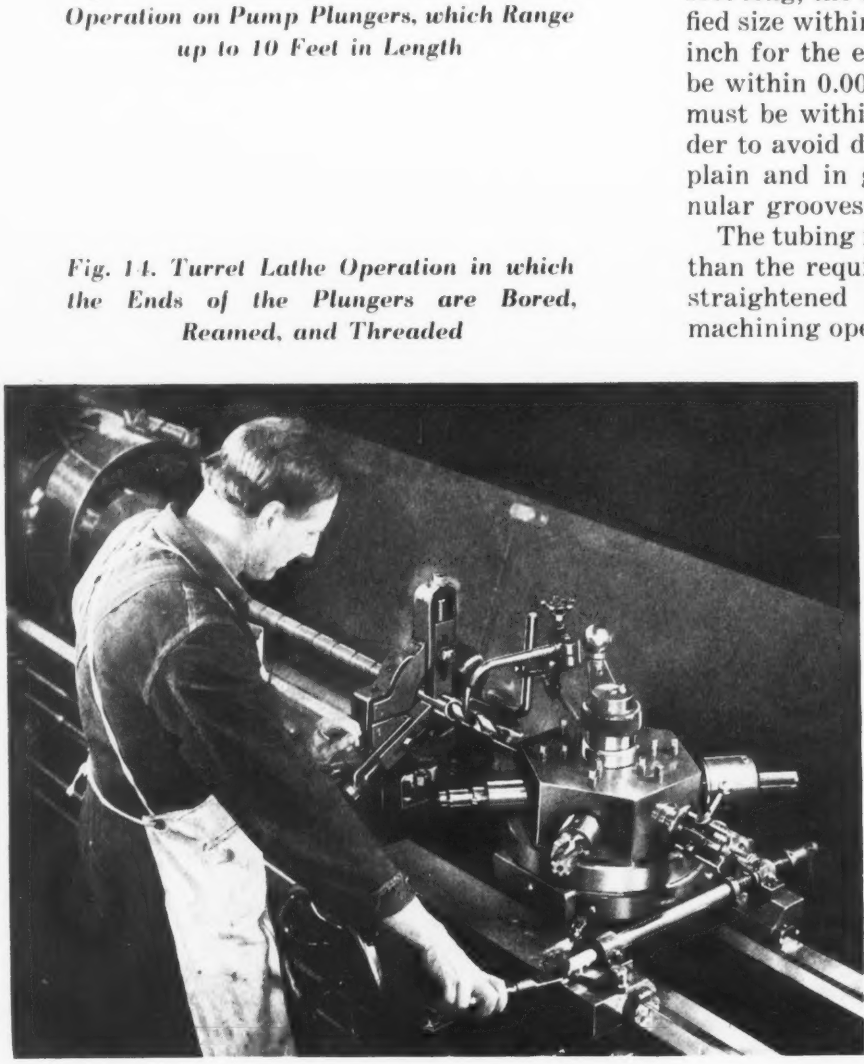


Fig. 13. Preliminary Centerless Grinding Operation on Pump Plungers, which Range up to 10 Feet in Length

Fig. 14. Turret Lathe Operation in which the Ends of the Plungers are Bored, Reamed, and Threaded



IN the first installment of this article, which was published in December, 1940, MACHINERY, the operations employed in manufacturing oil-pump liners at the plant of the Axelson Manufacturing Co., Los Angeles, Calif., were illustrated and described. The present installment will deal with the operations required in making the plungers for Axelson pumps, as well as operations pertaining to the valve seats.

The plungers are made of a seamless-steel tubing of S A E Specification 1045 in nominal outside diameters from 1 1/16 to 5 3/4 inches, and in lengths from 30 inches to 10 feet. Even with plungers 10 feet long, the outside diameter must be to the specified size within limits of plus nothing, minus 0.0005 inch for the entire length. The straightness must be within 0.003 inch, and the thickness of the wall must be within correspondingly close limits in order to avoid distortion. The plungers are made in plain and in grooved types, the latter having annular grooves around them every few inches.

The tubing for the plungers is cut 1/8 inch longer than the required finished length, after which it is straightened in a hydraulic machine. The first machining operation consists of rough-grinding the external surface in a centerless grinding machine, as shown in Fig. 13, to clean up the tube for its entire length and remove turning marks left by the mill operations.

The next operation consists of facing the ends of the plungers to length, and of boring, reaming, and threading each end. This operation is shown in Fig. 14 being performed on one of the grooved plungers, the machine used being an Axelson lathe equipped with a turret. All cuts are taken by tools mounted on the turret. Concentricity of the cuts is insured by holding the overhanging ground end of the plunger in a steady-rest. The bored diameter is checked with "Go" and "No Go" plug gages before threading, and with "Go" and "No Go" thread gages after threading.

Oil Fields By CHARLES O. HERB

High Quality Standards for a Period of More Than Forty Years—Second of Two Articles

Fig. 15. Lathe Operation Employed for Cutting the Annular Grooves in Plungers of the Grooved Type

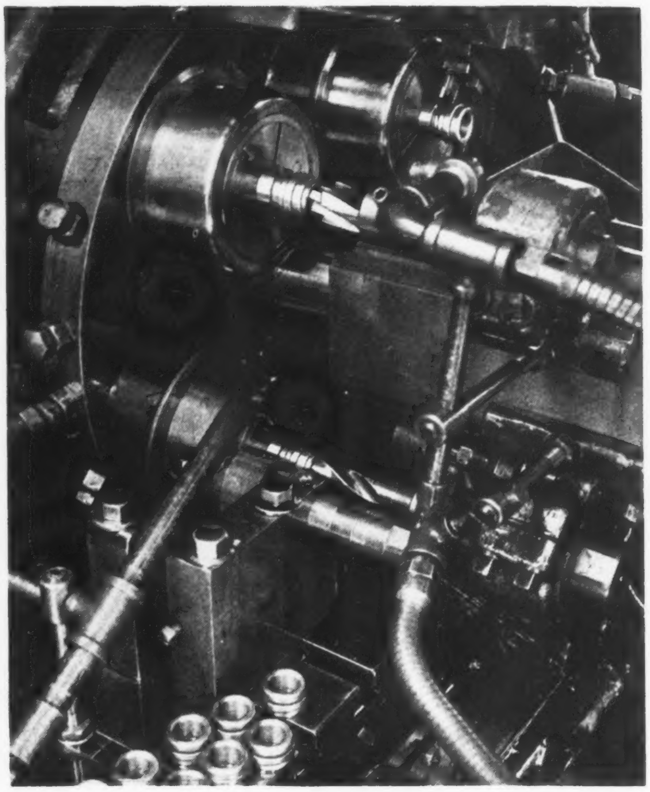
Some types of plungers are made from a nickel-molybdenum steel alloy of low carbon content and are carburized prior to the operations just described, except for the boring and facing of the ends. The latter operations are performed before hardening, so that the ends can be finish-bored and threaded after the heat-treatment. The annular grooves are turned on plungers of the grooved type after carburizing, but before quenching. This operation is shown in Fig. 15. The carriage is moved along the bed in the required increments between successive steps of the operation to obtain the necessary spacing. Five grooves are cut at each setting of the carriage.

The plungers next go to the cylindrical grinding machine shown in Fig. 16, for grinding the external diameter to within 0.002 inch above the specified size. For this operation, the plunger is held on centers which engage center holes in hardened and ground threaded plugs that are screwed into the ends of the plunger.

At the end of the external grinding operation, the plugs are removed and the plunger thoroughly cleaned on the inside, after which it is passed to a centerless grinding machine similar to that shown in Fig. 13 for finish-grinding. Stock to a depth of 0.0002 inch is left on the external surface for removal in a centerless polishing operation. This polishing operation is performed by the machine seen in Fig. 17, which is equipped with polishing and driving wheels 22 inches wide, or almost half the length of the plungers, which is 48 inches. The polishing wheels are of very fine grade, similar to an oil honing stone. At the end of the polishing operation the plungers must be true to size within the extremely close tolerance previously mentioned—that is, plus nothing, minus 0.0005 inch, regardless of their length.

Many precision operations are also involved in the manufacture of valve seats for Axelson pumps. When these seats are tested under

Fig. 16. Grinding the Plungers to Insure Accuracy of the Outside Surface with the Machined Ends



vacuum with their mating balls at the end of all operations, there must be no air leakage. The balls are purchased from other manufacturers, but are lapped in the Axelson plant, together with the seats to which they have been matched. The seats are produced from bar stock in the Gridley four-spindle automatic illustrated in Fig. 18, which bores, reams, and faces the pieces with tools mounted on the four stations of the main slide. At the same time, the pieces are completely formed on the outside and cut from the bar stock by tools mounted on cross-slides at the lower front, lower rear, and top rear stations of the machine. The cut-off end of the work is faced by means of a form reamer in a subsequent operation performed on a small lathe.

After being inspected, marked, and hardened and tempered, the seats reach the vertical-spindle surface grinding machine shown in Fig. 19 where both faces are ground flat and to the required thickness. This is the first of a series of grinding operations which not only produce an accurately sized seat, but also add to the corrosion resistance of the seat

Fig. 17. (Upper Left) Centerless Polishing Operation that Brings Plungers True to Size within Plus Nothing Minus 0.0005 Inch

Fig. 18. (Upper Right) Valve Seats for Axelson Pumps are Produced from Bar Stock in a Four-spindle Automatic

Fig. 19. (Left) The Faces of Valve Seats are Ground Parallel and to the Required Thickness on This Surface Grinding Machine

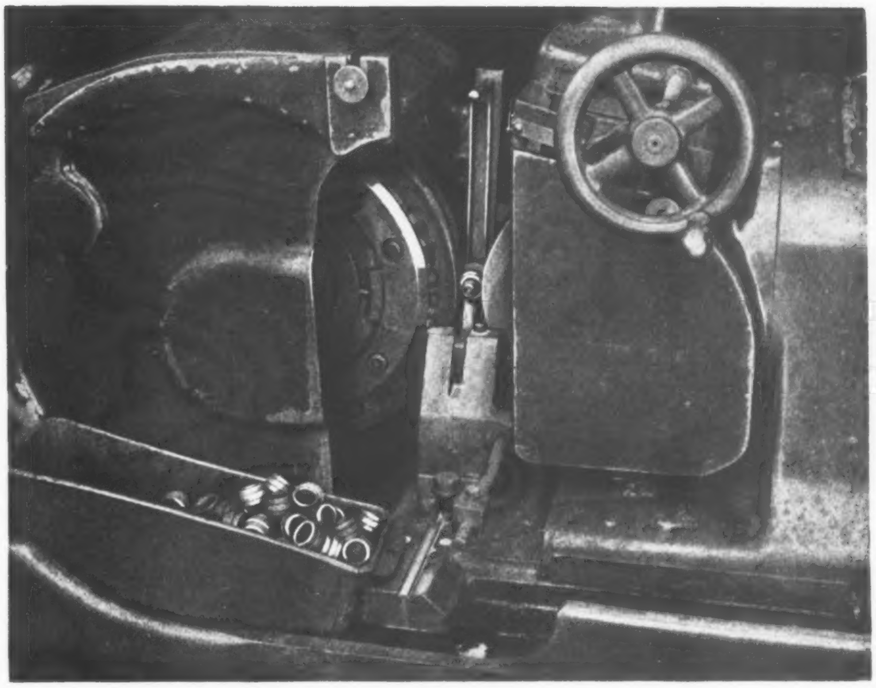


Fig. 20. Unusual Centerless Grinding Operation which Involves the Use of Grinding and Feeding Wheels Dressed to the External Contour of the Valve Seats

material by providing an extremely smooth all-over surface finish. Before the seats are removed from the magnetic chuck of the grinding machine, the current passing through the chuck is reversed, so as to demagnetize the work pieces.

The next operation consists of grinding the seats on a centerless grinding machine equipped, as illustrated in Fig. 20, with a vertical guide having a mandrel on which the seats are loaded one at a time. The grinding and feeding wheels are dressed to the contour of the seats. All three cylindrical surfaces are ground at the same time. The wheels are dressed by a diamond that is hydraulically operated over a master cam in order to produce the required contour. The mandrel on which the work pieces are loaded is moved into and out of the grinding position by means of a handle.

At the left in Fig. 21 is shown the method employed for grinding the shoulders of the seats to the required width. Two thin grinding wheels, spaced to the proper width, perform the operation as the work piece is fed to the wheels, the work being mounted on a split collet in the headstock. This method is employed to insure parallelism of the shoulders.

After an internal grinding operation, the parts reach the Rivett bench grinding machine shown in Fig. 22. This machine is arranged for grinding a seat in each end of the parts which, in the finished product, is a combination of concave and convex

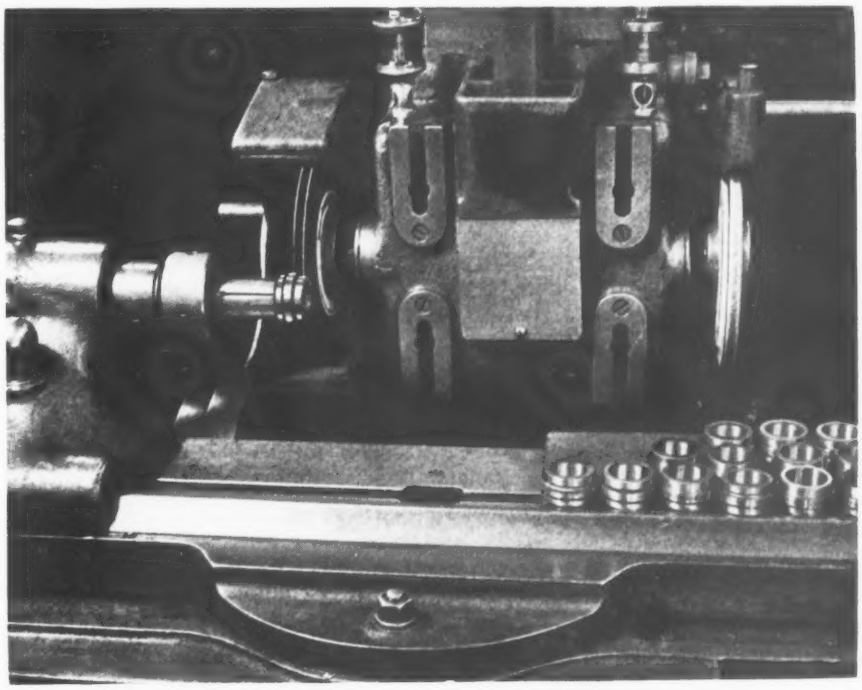


Fig. 21. The External Shoulders of the Valve Seats are Ground to the Required Width by the Use of Two Thin Wheels as Shown

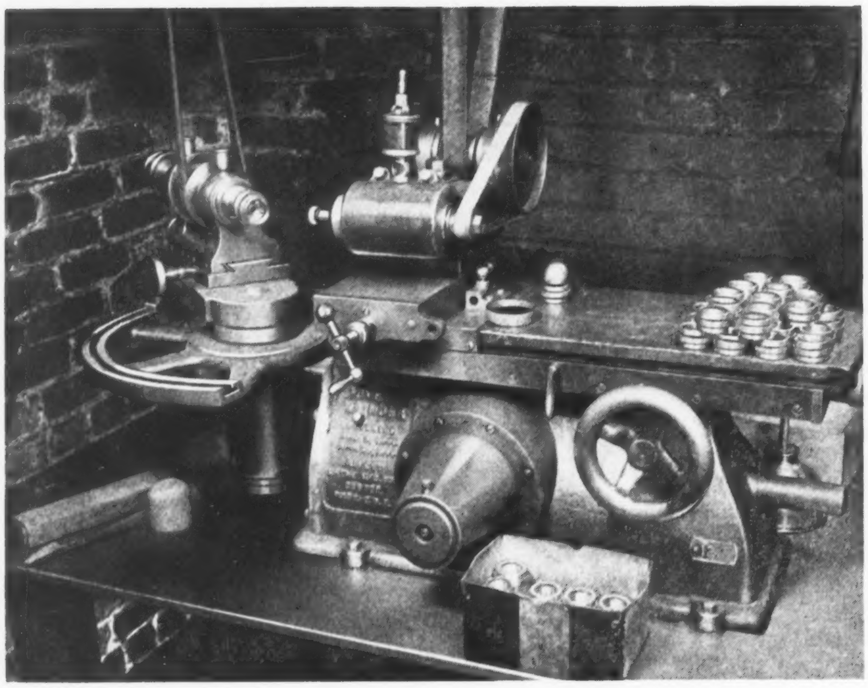


Fig. 22. Equipment Employed for Grinding a Combination of Concave and Convex Surfaces in Both Faces of the Valve Seats

curves. The convex curve starts at the outer end of the hole and merges into a concave curve that conforms to the shape of the ball to be mated with the seat. The concave curve then merges into the minimum bore diameter.

Grinding of the seat surface alone, however, is not considered sufficient to obtain the complete seal required between the seats and their mating balls. Therefore, each ball is lapped with its mating seat on machines developed and patented by the Axelson company. As shown in Fig. 23, these machines are equipped with rotating tables and work-heads that revolve off center with respect to the tables. Each head has six spindles that are equipped at the lower ends with adapters into which the valve seats are inserted. The seats are then permitted to rest on their mating balls and a downward pressure is applied by a spring on each spindle. The table tops are covered with rubber.

In this operation, an almost infinite number of compound motions of the balls is obtained and a fine grinding compound is applied. The length of each operation is controlled by a timing device to avoid excessive lapping, and at the end of the operation, the balls and seats have been lapped to an exceptionally fine fit.

The balls and seats are then thoroughly cleaned, and delivered to the inspection bench shown in

Fig. 23. The Valve Seats and Their Mating Balls are Lapped Together on Special Patented Machines to Insure Obtaining a Close Fit

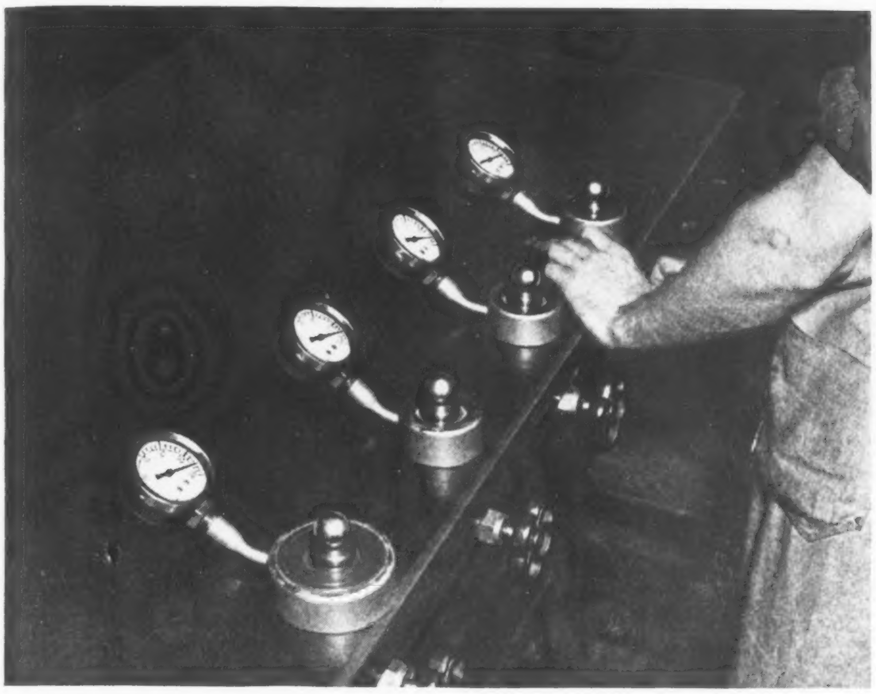


Fig. 24. Inspection Bench where Each Valve Seat and Its Mating Ball are Checked for Closeness of Fit by the Use of Vacuum

Fig. 24, where the lapped seats and balls are checked for closeness of fit. They are mounted on fixtures at the top of pipe lines from which air is withdrawn until a vacuum reading of at least twenty-eight inches is obtained. The fit between each ball and seat must be close enough to hold this degree of vacuum for a considerable length of time.

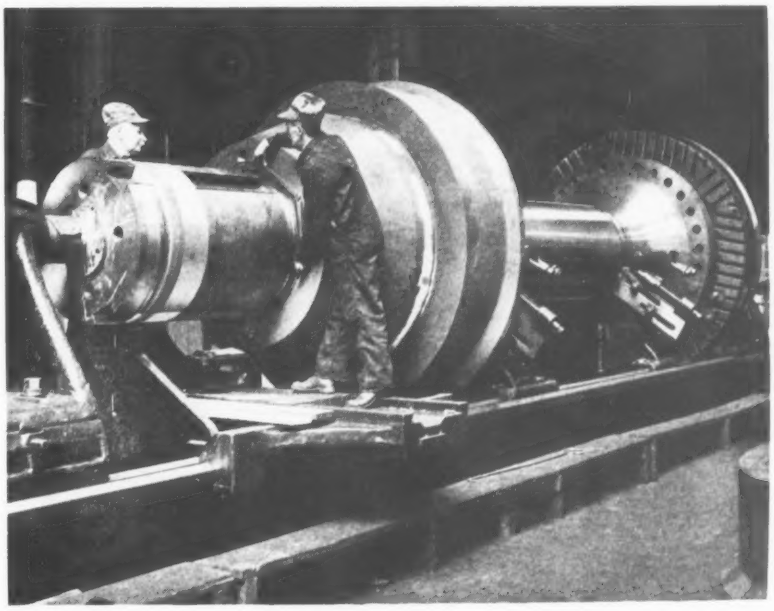
* * *

Life insurance companies have pointed out that few people die in hard times. The same thing holds true in business. Nobody fails in bad times. All failures come at the end of good times.—*James S. Knowlson, president, Stewart-Warner Corporation*

Great Increases in Industrial Activity Reported

Orders received by the General Electric Co., Schenectady, N. Y., during the year 1940 amounted to $654,000,000, as compared with $361,000,000 in 1939, an increase of 81 per cent. Of this, orders for national defense amounted to approximately $250,000,000. The total volume of business in 1940 was greater than that for any other year in the company's history.

The orders received during the last quarter of 1940 reached the all-time record for three months of $256,000,000, compared with $112,000,000 for the same quarter in 1939.



Huge Shaft for a 30,000-K.V.A., 13,800-volt Vertical Water-wheel Generator in the Allis-Chalmers Mfg. Co.'s Plant in Milwaukee, Wis. The Shaft is 34 Inches in Diameter and Over 21 Feet Long. The Thrust Block, which has been Shrunk on the Shaft, is Shown Being Machined. The Approximate Weight of the Shaft as Mounted in the Lathe is 105,000 Pounds

Chart for Determining Time Required for Machine Cuts

By LOUIS DE L. BERG

A chart for rapidly determining the hourly production of automatic or semi-automatic machines was shown in September, 1940, MACHINERY, on page 142. Another chart has now been developed for estimating the time required to complete a cutting operation on any machine tool in which either the work or the tool rotates. This chart, as shown in the accompanying illustration, can be used when the feed, length of cut, diameter of work, and surface speed are known.

The length of the cut and the diameter of the work are definite values determined from the sample or blueprint of the work. The amount of feed and the surface speed are indefinite figures, and are dependent upon the material, style of tool, width and depth of cut, etc. Practically all shop handbooks give complete data on these factors.

The use of the chart is best illustrated by taking an actual example and following the steps in its solution. Assume that a cut 1 3/4 inches long at a feed of 0.0035 inch is to be taken with a box-tool on a bar of S A E 1050 steel, 1 3/4 inches in diameter, at a recommended surface speed of 80 feet per minute. The first operation is to determine the number of revolutions of the spindle necessary to complete the cut. To do this, a straightedge—preferably of transparent celluloid, as this will not hide the figures it covers—is laid across the columns headed "Length of Cut" and "Feed," intersecting them at the known values. In the illustration, the dotted lines represent the straightedge. It will be noted that the line at the left intersects "Length of Cut" at 1.75 inches and "Feed" at 0.0035 inch. The extension of this line intersects the "Revolutions to Complete Cut" column at 500.

The revolutions per minute required to give the recommended surface speed is next determined by laying the straightedge across the columns headed "Diameter of Work" and "Surface Speed" at the points 1.75 and 80, respectively. The extension of

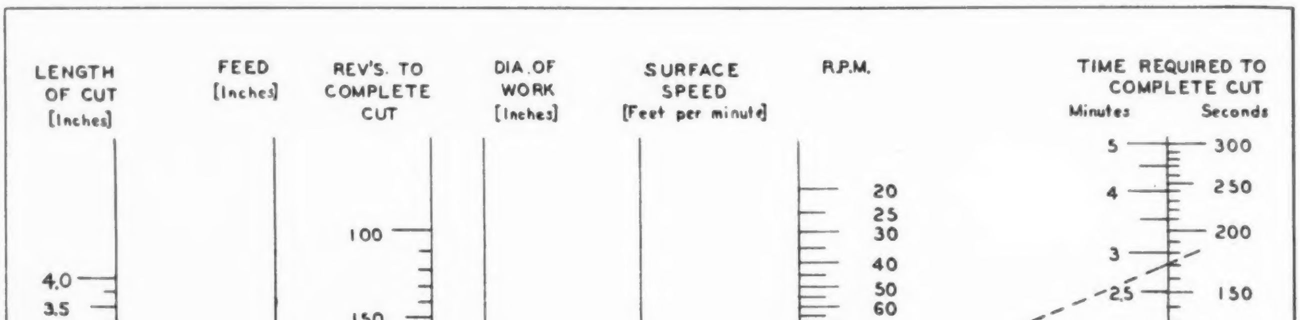


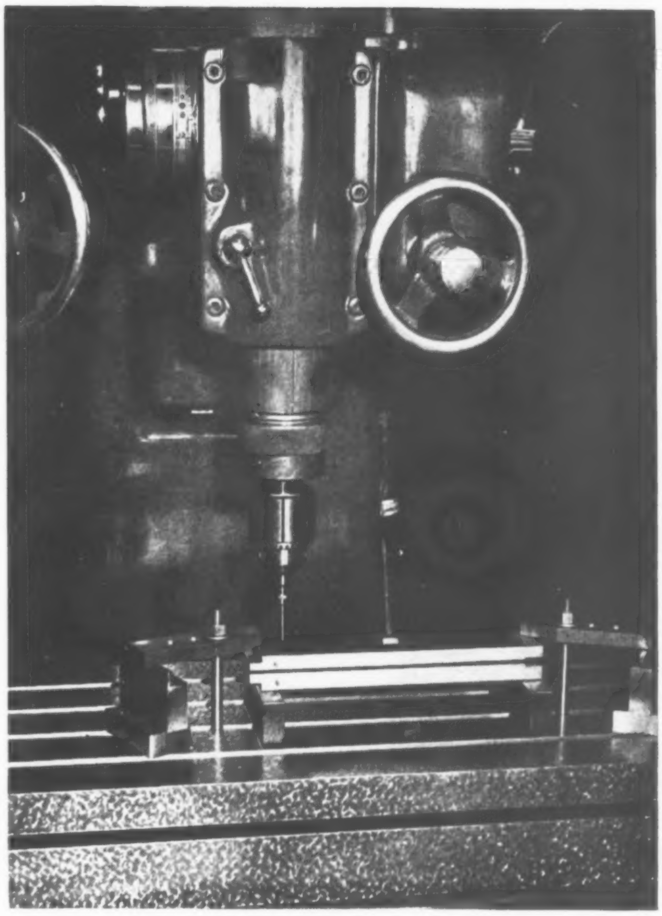
Chart for Determining Time Required to Complete Cut on Machine Tool when Feed, Length of Cut, Diameter of Work, and Surface Speed are Known

this line intersects the "R.P.M." column at 175, which is the required number of revolutions necessary to turn a piece 1 3/4 inches in diameter at a surface speed of 80 feet per minute.

The last step is to connect the 500 on the "Revolutions to Complete Cut" column with the 175 on the "R.P.M." column and continue the line—or straightedge—until it cuts the "Time" column at the right-hand side of the chart. The time will be found to be approximately 2.8 minutes, or almost exactly 170 seconds.

The example given is for work machined in a lathe, but similar calculations can be made for drilling and milling operations in which the tool rather than the work revolves. In such cases, it is only necessary to substitute the diameter of the drill or cutter for that of the work.

* * *

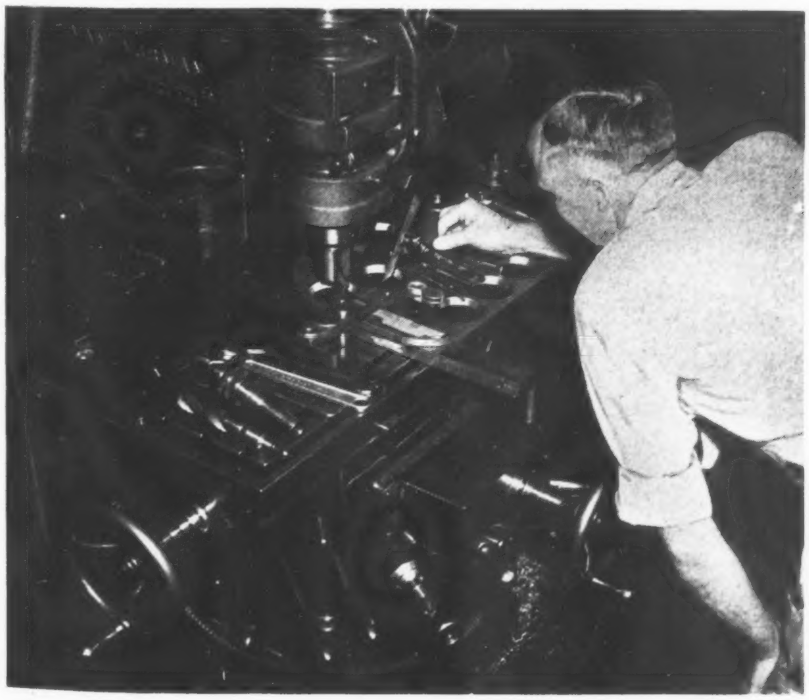


Employing a Precision Jig Borer for Drilling a Series of Seventeen Bushing Holes in a Drill Jig

Precision Boring Operations in an Aircraft Plant

The application of a Van Norman milling machine in the airplane-building factory of North American Aviation, Inc., Inglewood, Calif., for the accurate boring of a series of tapered holes in a steel plate is shown in the illustration below. Use was made of a tool that took a shaving cut the entire thickness of the plate after the holes were cut straight through by employing a series of drills.

The Cleereman jig boring machine shown in the illustration at the top of the page is kept busy on a variety of work in the tool-room of the same plant. In the illustration, this machine is shown set up for boring seventeen small holes in a drill jig to receive drill bushings. Limits of plus nothing, minus 0.001 inch had to be maintained between the center-to-center distances of the bushing holes.



Using a Universal Milling Machine for Finish-boring a Series of Tapered Holes in a Steel Plate

Engineering Progress has Outdistanced Politicians and Labor Leaders

In an address before the American Society of Tool Engineers, the speaker stated that if political and labor leaders could only catch up with the progress of the engineer, unemployment would be a thing of the past; but unemployment will never be a thing of the past through applying the methods now advocated by the Government and by most labor leaders. Somehow their policies, the speaker said, reminded him of the days when medical men knew of no better method to combat illness than by letting blood, which weakened the patient instead of strengthening him. It is not an exaggeration to say that the methods proposed and put into effect by our Government during the last eight years have had much the same effect on industry and employment—the effect of weakening the patient instead of making him better.

Boring Accurate Holes in Long Steel Tubes

The equipment shown in the accompanying illustrations was designed for boring accurate holes, 3 1/2 inches in diameter, in steel tubes 10 feet long. The tubes are made of steel which has a tensile strength of 90,000 to 100,000 pounds per square inch. The outside diameter of the finished tubes is 4 1/4 inches. The hole or bore in the tubes is required to have a high finish, and the diameter is held within limits of plus 0.002 and minus 0.000 inch. The hole must also be concentric within 0.008 inch and round within 0.002 inch.

The tubes are normalized before boring, so that they will remain straight even after considerable material has been removed. At least 1/4-inch material is allowed for finishing, in order to avoid trouble from surface seams or other defects. Tubes that are machined on the outside are held to close limits of accuracy, so that they can be supported in steadyrests, three steadyrests being used for this purpose.

Referring to Fig. 1, the tube is centralized by three brackets *A* with removable bearing caps that permit the work and the boring-bar to be readily removed after the bar has been slid endwise to free it from the driving chuck attached to the lathe spindle. The caps on the bearings of the brackets are hinged in a manner similar to that adopted for ordinary steadyrests. The boring-bar is supported in a similar cap bracket at its right-hand end.

An adequate supply of cutting fluid, preferably oil, is used under pressure. The oil is fed to the sliding tube *B*, which fits the outside of the tube and is bored close enough to avoid undue leakage and to be a running fit on the projecting end of the boring-bar chuck. When the outer surface of the tube is rough, a seal in the form of a rubber ring is employed.

As shown in the lower view, Fig. 1, the supporting bracket *C* can be extended beyond the end of the lathe. Sufficient space is allowed at the right-hand end of the tube to accommodate the combination boring and reaming cutter *D*, which is arranged to slide on the boring-bar. A split bushing is sometimes inserted in the left-hand end of the tube to maintain concentricity.

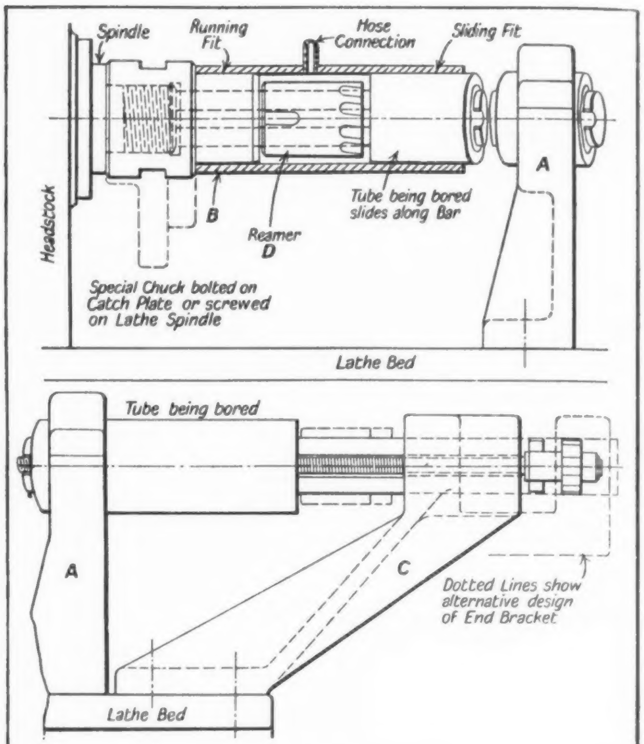


Fig. 1. General Arrangement of Tube Boring and Reaming Equipment

A cross-section, *A–A*, of the boring-bar is shown in Fig. 2, with a cross-section *B–B* of the driving end. The driving end is slotted to receive a rectangular block *C* of gun-metal, which serves as a driving key and as a bearing for the feed-screw. A slot is cut the entire length of the boring-bar to receive the feed-screw and the bearing block, which is a good sliding fit in the chuck.

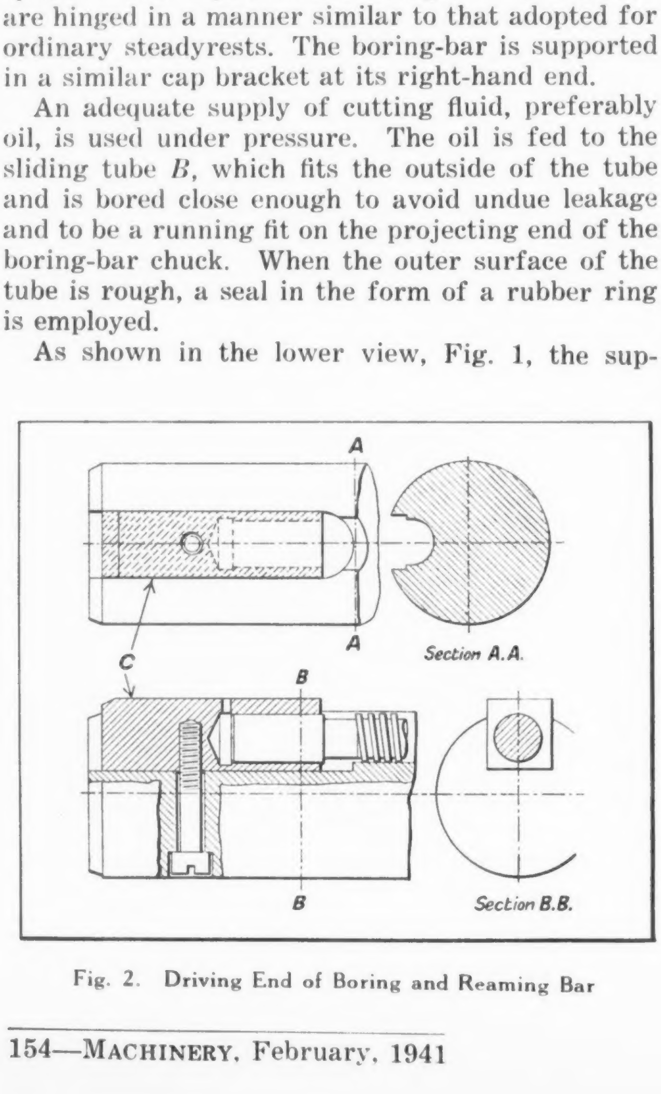


Fig. 2. Driving End of Boring and Reaming Bar

Two types of cutters are used, the body of the one shown in Fig. 3 being made of gun-metal or strong cast iron. The form of the cutters and the way in which they are held are shown by the two views. The cutter shown in Fig. 4 is made of high-speed steel. Its general form is shown by the views *A* and *B*. These views show the teeth before they have been relieved as indicated by the development at *C* and in sections *D* and *E*. The illustrations at the right, Fig. 4, give a good idea of the progressive action of the cutting teeth. Two teeth *a* spaced 180 degrees apart serve to lead the tool and true up the hole at a rate of feed that has been found by experience to give the most accurate results. The two following teeth *b* have a conical cutting action, which tends to prevent the tube from being forced out of its concentric position. Following these teeth, there are four other blades *c*. Accuracy of the bore

with respect to the diameter is obtained by means of the reamer teeth, which can be brought to the correct size by cylindrical grinding.

The intermittent feed mechanism is shown in Fig. 5. As the tooth of a star-wheel makes contact with one or more stops, the feed-screw makes one tenth of a turn. With one stop in operation, the one-tenth turn is made while the bar makes one turn plus the part of a turn represented by the angle θ. With two stops in operation, the one-tenth turn is made while the bar makes one-half a turn plus the angle θ. During this portion of a turn of the bar, the feed is 0.01 inch. This feed can be increased by providing extra stops. The stops can be of a swinging type, located at regular intervals around a ring attached to the boring-bar bracket *C*, Fig. 1. On completing the boring operation, the cutter can be slid axially from the feed-nut, permitting the nut to be removed and relocated at the starting end of the feed-screw.

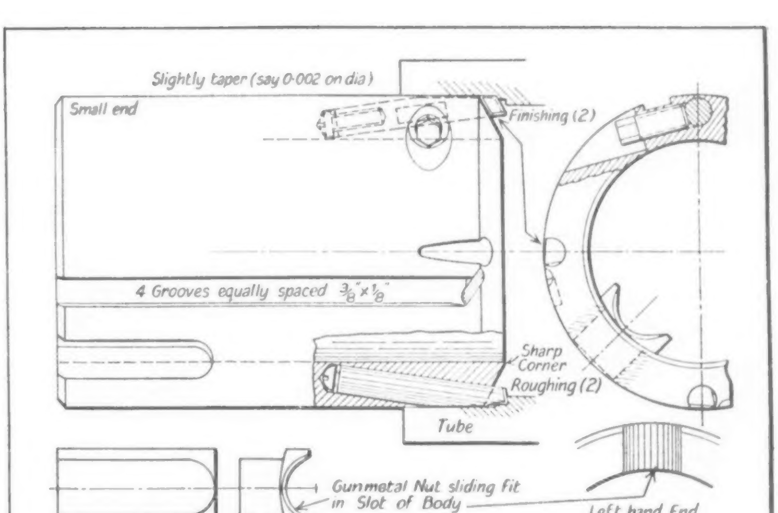


Fig. 3. Boring and Reaming Head for Long Tubes

* * *

Rubber Tires for Wheelbarrows

Wheelbarrows may now be equipped with a rubber tire which combines the advantages of both the pneumatic and solid types. The new tire has been developed by the B. F. Goodrich Co., Akron, Ohio. It is known as the "cushion type" tire and instead of being filled with air, it is filled with highly resilient cushioning rubber. Like the pneumatic tire, it combines lightness with high cushioning qualities and has the load-carrying capacity of a four-ply pneumatic tire. This type of tire is available for carrying capacities of 240 and 645 pounds.

New Fluorescent Lamp for Drafting-Boards

A new application of fluorescent lighting has been developed by the Frederick Post Co., P.O. Box 803, Chicago, Ill., whereby a light is provided for drafting-boards that approximates north daylight. The feature of this light is the pigment-treated reflector, the "artificial sky" of which produces a neutral, colorless, reflected light. The new development, known as "Fluorescent Engineers Lite," is said to produce two and one-half times the light intensity of an incandescent light using an equal amount of power. Furthermore, fluorescent light gives cool illumination and permits working close to the light source. For a given intensity, fluorescent light produces only one-fifth as much heat as incandescent light. The fixture is available in two models, one that is fastened to the drawing-board by a C-clamp, and one having a screw anchor attachment for permanent installation.

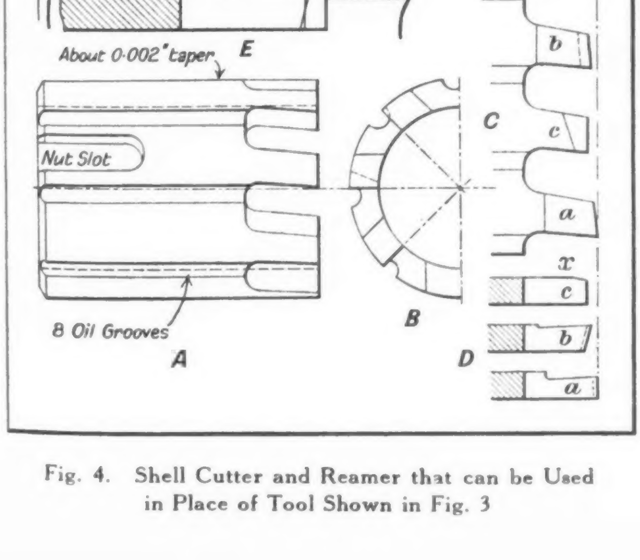


Fig. 4. Shell Cutter and Reamer that can be Used in Place of Tool Shown in Fig. 3

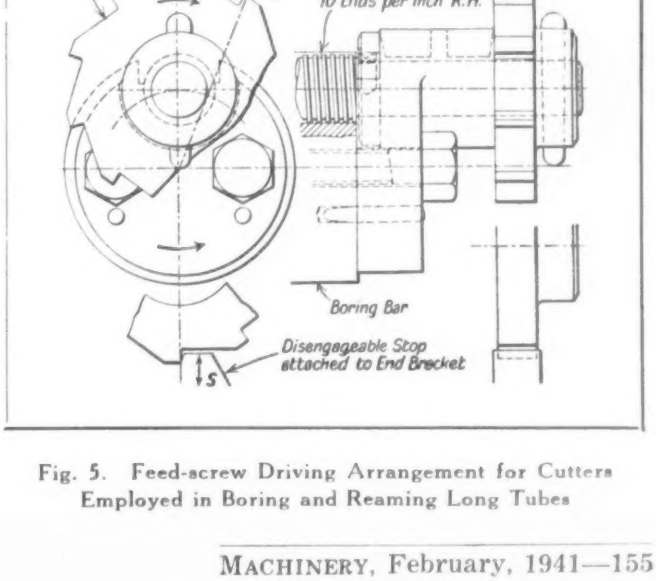
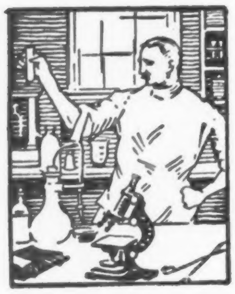


Fig. 5. Feed-screw Driving Arrangement for Cutters Employed in Boring and Reaming Long Tubes

MATERIALS OF INDUSTRY



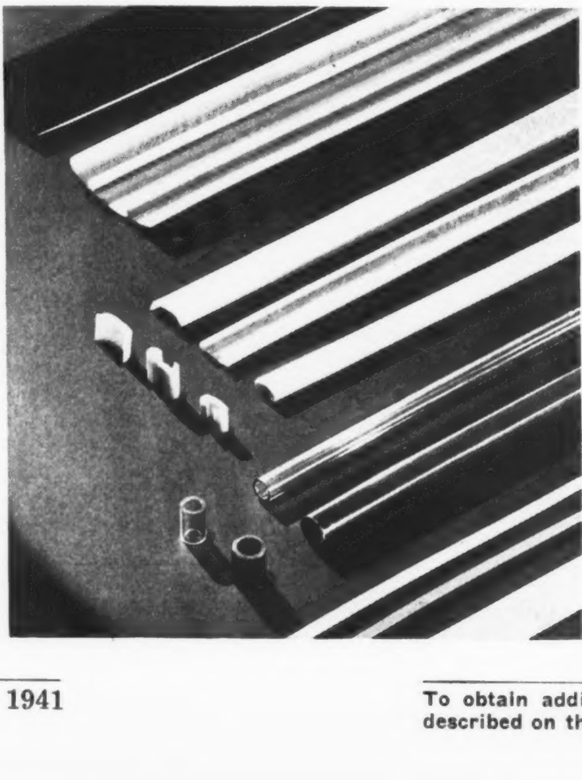
THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Porcelain Type Finish Permits Lower Burning Temperatures

A new inorganic finish that withstands heat and hard usage and has all the features of porcelain enamel has been placed on the market by the Porcelain Enamel & Mfg. Co., Baltimore, Md., under the name of "Pyroflex." This finish requires about one-half the burning time of baked-on enamels, reduces the burning temperatures 200 degrees F. below those previously required by porcelain enamel, and permits the use of lighter gage enameling or black iron. No special metal bonding treatment is necessary. Pyroflex is available in a wide range of colors and grain finishes...........201

Plastic Extrusion Process for Continuous Lengths

The development of a new process for extruding plastics that makes possible the manufacture of individually designed moldings, strips, tubing, rods, etc., in continuous lengths has recently been announced by the Detroit Macoid Corporation, 12340 Cloverdale Ave., Detroit, Mich. The new extruded forms are available in a wide range of shapes and colors, and can be obtained in either opaque, translucent, or transparent materials. The economies of this process, which, in part, result from low die costs and the extensive adaptability of the plastics utilized, are bringing about new applications in the automotive, aircraft, furniture, refrigerator, electrical, and decorative display fields..................................202



Examples of Plastic Forms Produced in Continuous Lengths by New Extrusion Process

Molybdenum Cast Iron for Distributor Gears

It has long been an axiom among automotive engine builders that distributor gears should be hard but not heard. According to the *Moly Matrix*, published by the Climax Molybdenum Co., cast-iron gears were recognized as a possible solution to the noise problem some time ago. They are quiet, comparatively inexpensive, and can be obtained in the hardness necessary to make them wear resistant. They had, however, one great disadvantage. When the iron had the necessary hardness, it was for all practical purposes unmachinable.

Recent experience with cast-iron distributor gears shows that the addition of molybdenum to iron containing a balanced content of chromium and nickel is a cure for the machining difficulty. The presence of molybdenum induces transformation during the usual cooling cycle at a temperature that insures sufficient strength and hardness without affecting the machining qualities.

One large manufacturer of automotive distributor gears uses the following composition for nickel-chromium-molybdenum iron: Total carbon, 3.20 to 3.40 per cent; manganese, 0.60 to 0.70 per cent; silicon, 2.10 to 2.30 per cent; nickel, 0.20 to 0.30 per cent; chromium, 0.60 to 0.80 per cent; molybdenum, 0.50 to 0.60 per cent.

To obtain additional information about materials described on this page, see lower part of page 160.

The physical properties of this iron "as cast" are: Tensile strength, 47,000 to 55,000 pounds per square inch; transverse strength, 3000 to 3300 pounds per square inch; deflection, 0.24 to 0.30 inch; Brinell hardness, 286 to 302.

Other automotive engine builders have already adopted irons of similar analysis. 203

Nickel Cast Iron Employed in Diesel Engines

In liners for large power station and marine Diesel engines, good results have been obtained with an iron containing about 1.50 per cent nickel and 0.25 to 0.50 per cent chromium, with a fine-grained, uniform structure, according to *Nickel Cast Iron News*, published by the International Nickel Co. Some other types of engines use an iron of moderate carbon content, having a somewhat coarse and open graphitic structure, but with the matrix hardened by the use of alloys, as for example, 2 to 3 per cent nickel. Such an iron has good resistance to abrasion, and the open graphite structure is conducive to good lubrication.

The main requirement in cylinder head castings is pressure tightness, and secondarily, resistance to growth or cracking. An iron of controlled composition with an addition of 1 to 1.5 per cent nickel is frequently employed. The nickel is added to a low-silicon base iron, and, in some cases, chromium is also added to provide density and heat resistance under working conditions.

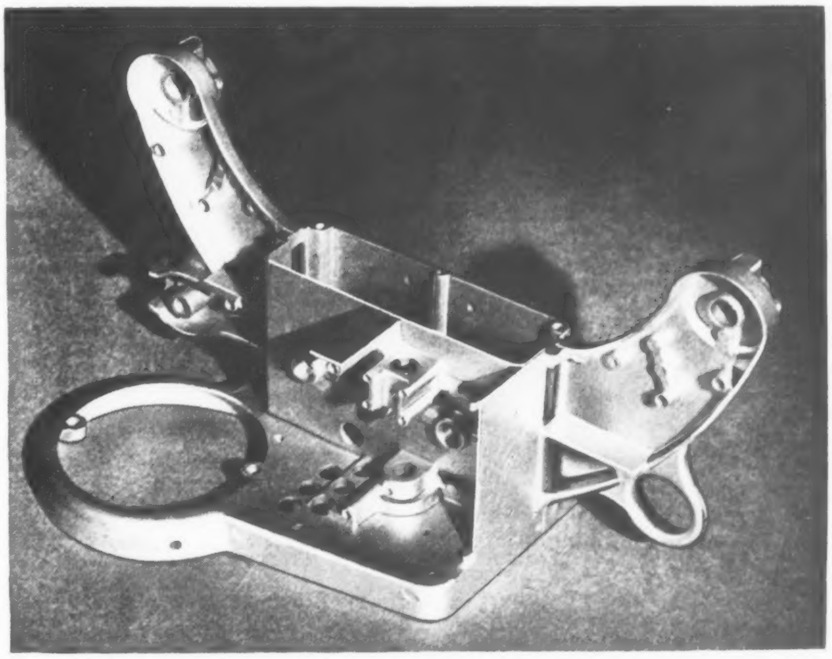
Castings such as cylinder heads and parts of more or less complicated shape should be given a stress-relief anneal before final machining to assure stability in service by eliminating all casting stresses. For Diesel pistons, an iron of similar composition to that recommended for liners can be employed. The high-strength irons offer the advantages of greater rigidity and strength in such castings as frames and flywheels; they enable iron castings to be adopted for more rigorous conditions than are normally permissible.

Extensive investigation has now established the fact that a modern high-duty cast iron has good resistance to the effects of fatigue, and is less sensitive to notch effects than steel. Cast iron, in general, has the capacity of damping out vibrations to a greater extent than steel. Its wear resistance, in addition to these considerations, has led to its adoption for crankshafts where design changes can compensate for its lower static strength. It is also used similarly for camshafts. 204

High-Strength, Corrosion-Resistant Aluminum Alloys

Two new aluminum alloys—Nos. 40 and 40-E—produced by the Frontier Bronze Co., Niagara Falls, N. Y., feature high strength or high ductility, ability to take a high polish, and good resistance to corrosion. The high-strength alloy—No. 40—has a tensile strength of 35,000 to 40,000 pounds per square inch, a yield point of 30,000 to 35,000 pounds per square inch, an elongation in 2 inches of 0.5 to 3.0 per cent, a Brinell hardness (500 kilogram load) of 80 to 90, and a modulus of elasticity of 10,700,000.

The high-ductility alloy—No. 40-E—has a tensile strength of 32,000 to 36,000 pounds per square inch, a yield point of 22,000 to 28,000 pounds per square inch, an elongation in 2 inches of 4.0 to 7.0 per cent, a Brinell hardness (500 kilogram load) of 70 to 80, and a modulus of elasticity of 9,020,000. 205



A Motion-picture Projector Frame for an Ampro Projector, Die-cast in One Piece from Zinc Alloy. This Intricate Casting is an Excellent Example of What can be Done by the Die-casting Process. The Wall Thickness Averages 0.059 Inch; the Weight is 30 Ounces; and the Over-all Dimensions are 9 5/8 by 6 by 5 1/4 Inches. The Tensile Strength of the Alloy from which the Frame is Cast is Over 40,000 Pounds per Square Inch

To obtain additional information about materials described on this page, see lower part of page 160.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Fill in on Form at Bottom of Page 159 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the February Number of MACHINERY

Deep-Hole Drilling and Reaming Equipment

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford, Conn. Circular 451, on deep-hole drilling machines for holes up to 1 inch in diameter. Circular 452, on deep-hole drilling machines for holes up to 2 inches in diameter. Circular 453, on deep-hole reaming machines. 1

Nickel Alloys for Pump Parts

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Folder entitled "Practical Pumping Problems and How They Are Solved," discussing the use of Monel, K-Monel and S-Monel for pump parts to meet the need for high resistance to corrosion, wear, pitting, or scoring. 2

Grabs for Overhead Materials-Handling

CLEVELAND TRAMRAIL DIVISION OF CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Catalogue showing typical installations of the latest cab-controlled motor-driven grabs, as well as standard grabs and lifts, for overhead materials-handling. 3

Arc Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio, is distributing a publication entitled "It's Welding Time," containing information on the latest equipment and methods used in arc welding. Actual applications of the welding process on a wide variety of work are illustrated. 4

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Circulars GEA-978B, on high-speed induction motors for direct connection; GEA-3479, on air-conditioning and refrigeration-compressor motors; and GEA-3488, entitled "How to Maintain D.C. Motors." 5

Blast Cleaning Equipment

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Booklet entitled "What Users Say About Wheelabrator Performance," containing the experiences of sixty-four users with Wheelabrator airless, abrasive blast cleaning equipment. 6

Apparatus for Checking Thermo-Couple Pyrometers

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Catalogue E-33A-503, listing equipment needed to check thermo-couple pyrometers in plant and laboratory. 7

Machines and Tools for Sheet-Metal Shops

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Booklet illustrating and describing Niagara folders and brakes, squaring shears, presses, and other sheet-metal working machines. 8

Screw-Cutting Lathes

SOUTH BEND LATHE WORKS, 720 E. Madison St., South Bend, Ind. Catalogue 100-A, showing fifty different sizes and types of South Bend back-geared screw-cutting lathes for manufacturing, tool-room, and general shop work. 9

Machine Tools and Shop Equipment

ATLAS PRESS CO., 153 N. Pitcher St., Kalamazoo, Mich. General catalogue No. 41, on shop equipment inincluding lathes, drilling machines, shapers, milling machines, vises, tools, and accessories. 10

Variable-Speed Control

REEVES PULLEY CO., Columbus, Ind. Booklet G-412, entitled "How to Speed up Production with Variable-Speed Control," showing thirty-six examples of the use of Reeves variable-speed control in a wide variety of industrial plants. 11

Bakelite Molding Plastics

BAKELITE CORPORATION, UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York City. Booklet covering Bakelite molding plastics—properties, characteristics, applications, and methods of fabrication. 12

Gear Cutting and Checking

MICHIGAN TOOL CO., Detroit, Mich. Bulletin 270, containing change-gear formulas and formulas for calculating hobbing time, hob checking equipment information, and other data of value to production men and engineers. 13

Speed Lathes

SCHAUER MACHINE CO., 2060-68 Reading Road, Cincinnati, Ohio. Catalogue 400, covering the company's line of high-production bench and pedestal speed lathes for finishing, polishing, burring, or lapping small parts. 14

Power Hammers

NAZEL HAMMER DIVISION OF LOBDELL CAR WHEEL CO., Wilmington, Del. Booklet describing the Nazel electrically driven power hammer, and illustrating actual installations of these machines, applied on a variety of work. 15

Standard Steel Shapes

COMMERCIAL SHEARING & STAMPING CO., Youngstown, Ohio. Booklet illustrating and describing a number of circular steel shapes which can be purchased as standard production parts, thus eliminating tool and die expense. 16

Gas Cutting Machines

AIR REDUCTION, 60 E. 42nd St., New York City. Bulletins ADC 627 and 614A, describing, respectively, the No. 4 and the No. 10 Radiagraph—two different types of portable motor-driven, gas cutting machines. 17

Horizontal Boring Mills

DEFIANCE MACHINE WORKS, INC., Defiance, Ohio. Catalogue illustrating and describing the outstanding features of Defiance horizontal boring, milling, drilling, and tapping machines, which are made in two models. 18

Hydraulic Control Equipment

JOHN S. BARNES CORPORATION, 301 S. Water St., Rockford, Ill. Circulars illustrating and describing Barnes hydraulic power and control panel with speed adjustment, and Barnes hydraulic index power and control panel. 19

Non-Magnetic Steel

JESSOP STEEL CO., 605 Green St., Washington, Pa. Circular descriptive of Jessop non-magnetic steel—a machinable, austenitic steel developed especially for the electrical industry. 20

Heat-Treating Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Folder describing "Endogas" heat-treating equipment for hardening all steels clean, scale-free, and without decarburization. 21

Cord Conveyor Belts

B. F. GOODRICH CO., Akron, Ohio. Catalogue on Goodrich cord conveyor belts, which are claimed to have the advantages of greater impact resistance, longer belt life, and savings in belt and conveying costs. 22

Special Steels

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa. Handbook of special steels, covering properties and uses. A directory of fabricators of tool steels and Allegheny metal products is included. 23

Automatic Lathes

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue containing complete information on the 12-inch Fay automatic lathe, together with data on typical jobs done on this machine. 24

Welding Gage

CHICAGO TOOL & ENGINEERING CO., 8391 S. Chicago Ave., Chicago, Ill. Circular 4100, descriptive of a new pocket-size welding gage that makes it possible to accurately calibrate butt and fillet type welds. 25

Graphitic Steels

TIMKEN ROLLER BEARING CO., Canton, Ohio. Bulletin giving information on results obtained through the use of the graphitic steels Graph-Sil, Graph-Mo, and Graph-Tung. 26

Welded and Weldless Chain

COLUMBUS MCKINNON CHAIN CORPORATION, Tonawanda, N. Y. Catalogue 8, containing useful information on this company's entire line of welded and weldless chain. 27

Electric Transformers

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo. Circular describing a new type of transformer known as "Noflamol," which is filled with a non-inflammable synthetic liquid. 28

Press Brakes

VERSON ALLSTEEL PRESS CO., 9300 S. Kenwood Ave., Chicago, Ill. Bulletin MBP40, containing data on Major press brakes for forming, bending, coping, notching, and multiple punching. 29

Multi-Purpose Honing and Sanding Tools

H & H RESEARCH CO., 12540 Twelfth St., Detroit, Mich. Bulletin describing portable reciprocating tools that can be used for sanding, sawing, honing, and filing. 30

Collet Chucks

ERICKSON STEEL CO., E. 80th St. and Bessemer Ave., Cleveland, Ohio. Folder entitled "Greater Speed, Accuracy, and Economy for Production Work," describing the Erickson precision collet chuck. 31

Leather Belting and Products

ALEXANDER BROTHERS, 406 N. 3rd St., Philadelphia, Pa. 32-page catalogue on leather belting and leather products, containing engineering tables and data, and much useful information. 32

"Oil-Cushioned" Bronze Bearings

BOSTON GEAR WORKS, INC., North Quincy, Mass. Catalogue 0-3, on Oilite

To Obtain Copies of New Trade Literature

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No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm ....

Business Address ....

City .... *State* ....

[SEE OTHER SIDE]

oil-cushion precision bronze bearings and Oilite bronze rough stock, giving sizes regularly carried in stock. 33

Potentiometer Pyrometers

BROWN INSTRUMENT CO., 4485 Wayne Ave., Philadelphia, Pa. Catalogue 1104, describing indicating, recording, and control pyrometers of the potentiometer type. 34

Stainless-Clad Steel

INGERSOLL STEEL & DISC DIVISION, BORG-WARNER CORPORATION, 310 S. Michigan Ave., Chicago, Ill. Manual of welding and fabricating procedures for Ingaclad stainless-clad steel. 35

Hydraulic Cylinders

TOMKINS-JOHNSON CO., 617 N. Mechanic St., Jackson, Mich. Catalogue H-40, entitled "Hydraulic Cylinders for Greater Efficiency in Hydraulic Power Movement." 36

Industrial Drying Lamps

WESTINGHOUSE ELECTRIC & MFG. CO., LAMP DIVISION, Bloomfield, N. J. Booklet A-3817, on radiant heat drying lamps for industrial drying, baking, and heating. 37

Ball Bearings

STEPHENS-ADAMSON MFG. CO., Aurora, Ill. Catalogue 840, covering the SealMaster line of permanently sealed, pre-lubricated, self-aligning ball-bearing units. 38

Steel-Core Round Belting

SUDBURY LABORATORY, South Sudbury, Mass. Circular announcing a new type of round belting made with a steel spring core, known as "Round-Tex." 39

Machining Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. 32-page book, 8 1/2 by 11 inches, entitled "Practice in Machining Zinc Alloy Die-Castings." 40

Hoists and Cranes

WRIGHT MFG. DIVISION OF THE AMERICAN CHAIN & CABLE CO., INC., York, Pa. Catalogue 12-C, on hand-operated hoisting equipment, trolleys, and cranes. 41

Brazing Alloys

HANDY & HARMAN, 82 Fulton St., New York City. Folder describing the two low-temperature brazing alloys "Sil-Fos" and "Easy-Flo." 42

Bore Gages

STANDARD GAGE CO., INC., Poughkeepsie, N. Y. Bulletin descriptive of improved dial bore gages applicable to aircraft engine parts. 43

Pneumatic Chucking Devices

ANKER-HOLTH MFG. CO., Port Huron, Mich. Catalogue illustrating and describing the "Airgrip" chucking devices. 44

Engraving Machines

MICO INSTRUMENT CO., 10 Arrow St., Cambridge, Mass. Catalogue illustrating and describing the Mico pantograph engraving machine. 45

Threading Alloy Steels

GEOMETRIC TOOL CO., New Haven, Conn. Booklet containing information on the proper methods of threading alloy steels. 46

Electric Hoists

READING CHAIN & BLOCK CORPORATION, Reading, Pa. Bulletin 1004, entitled "144 Answers to Your Hoisting Problems." 47

Toggle Pliers

KNU-VISE INC., 16841 Hamilton Ave., Detroit, Mich. Circular describing "Knu-Lok" rapid-action toggle pliers. 48

Portable Electric Tools

BLACK & DECKER MFG. CO., Towson, Md. 1941 catalogue on the Black and Decker line of portable electric tools. 49

Welding Rods

AIR REDUCTION, 60 E. 42nd St., New York City. Circular announcing a new "Hi-Test" flux-coated bronze welding rod. 50

Electric Motors

LIMA ELECTRIC MOTOR CO., Lima, Ohio. Bulletin on electric motors; also bulletin on gear-shift motors and selective speed drives. 50-A

Arc Welders

EMERSON ELECTRIC MFG. CO., St. Louis, Mo. Catalogue on alternating-current arc welders. 50-B

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 161-173 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description on pages 161-173 — or write directly to the manufacturer, mentioning machine as described in February MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 156-157 fill in below the identifying number found at end of each description on pages 156-157 — or write directly to the manufacturer, mentioning name of material as described in February MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

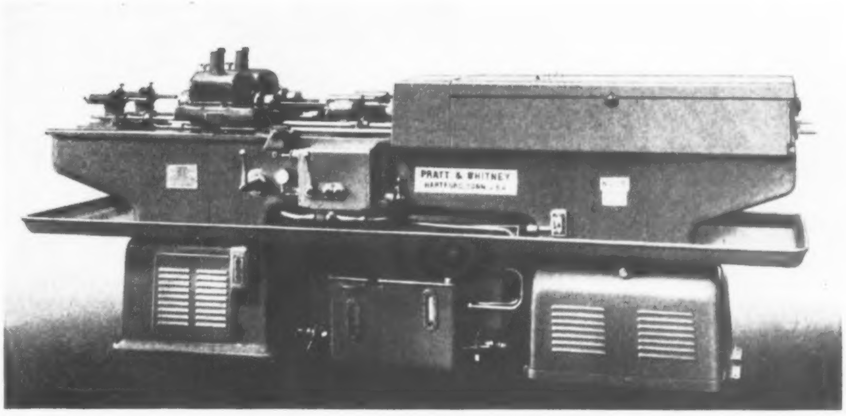


Fig. 1. Pratt & Whitney No. 1/2B Gun-barrel Rifling Machine

Pratt & Whitney Gun-Barrel Rifling and Chambering Machines

A new rifling machine designed to meet modern production requirements of speed and accuracy has been brought out by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Two complete rifling units, as shown in Fig. 1, and many new features, including hydraulic control, have been incorporated in this machine.

The barrel to be rifled is held in a work-spindle by means of a collet chuck that indexes the work after each rifling cut. The end of the barrel is steadied by the work end support. The tool-slide drives the rifling tool and controls the pitch of the grooves by means of a leader and nut.

At the start of the operation, the rifling tool extends through the work to the tool feeding device at the extreme left end of the machine bed. The operation starts as the pull type hook cutter or rifling tool is drawn to the right through the barrel. Upon the return of the cutter, the barrel is automatically indexed into position for cutting the next groove. After the barrel has been indexed through a complete revolution and a cut taken for each groove, the rifling tool is fed outward automatically so that the grooves are cut deeper by the second and succeeding series of cuts. When the rifled grooves have reached a predetermined depth, the feed stops. This complete cycle is accomplished automatically.

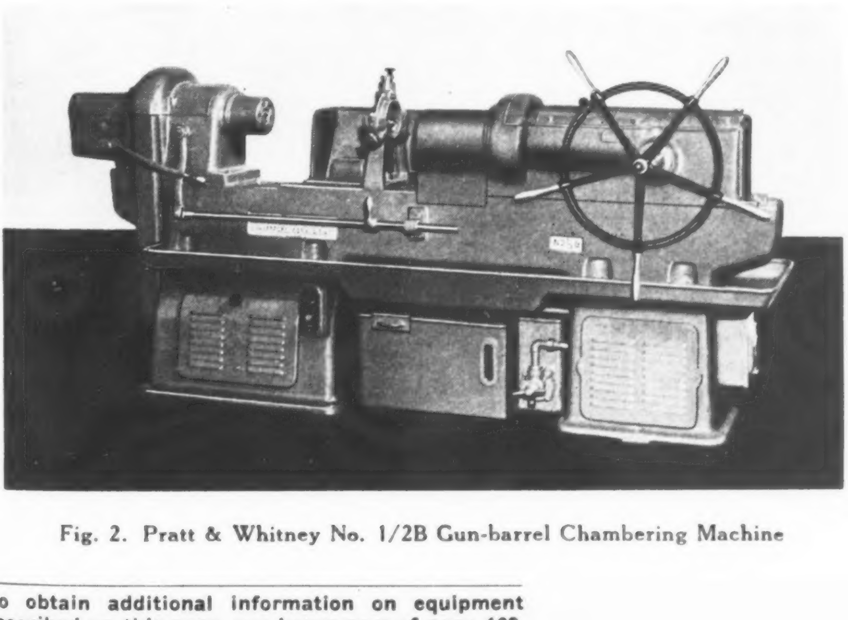


Fig. 2. Pratt & Whitney No. 1/2B Gun-barrel Chambering Machine

Coolant is fed to the cutter through a hole which runs the length of the rifling tool. A small motor-driven revolving brush at the tool-slide end of each gun barrel cleans the chips from the tool.

This rifling machine is made in two models. The smallest machine, designated as No. 1/2B will rifle gun barrels having a maximum rifling diameter of 5/8 inch. It is made in two bed lengths for rifling barrels 30 and 50 inches in length, respectively. The machine can be furnished to cut any rifling pitch desired and any number of grooves from 4 to 8. The hole through the work-spindle is 2 3/8 inches in diameter. The carriage can be given any cutting speed desired from 0 to 50 feet per minute and any return speed from 0 to 65 feet per minute. The minimum cutter feed per stroke is 0.00006 inch. The machine for handling 30-inch work requires a floor space 136 inches long by 42 inches wide and weighs 6900 pounds, while the machine for handling work up to 50 inches in length is 176 inches long and weighs 7300 pounds.

The larger or 1B machine will rifle bores up to 1 1/8 inches in diameter and is made in three lengths to handle barrels 50, 74, and 98 inches in length, cutting any number of grooves from 5 to 12. The hole through the work spindle is 4 inches in diameter. The largest of these machines requires a floor space 319 3/4 inches long by 53 5/8 inches wide and weighs 12,250 pounds.

To obtain additional information on equipment described on this page, see lower part of page 160.

The No. 1/2B gun-barrel chambering machine, shown in Fig. 2, is another new machine recently placed on the market by Pratt & Whitney. This machine performs the various precision operations in the butt end of a previously drilled, reamed, and rifled gun barrel, as required to accurately form the chamber that receives the cartridge. The gun barrel is held at one end in the work-spindle by a lever-operated collet chuck. Its outer end is supported in an adjustable lathe type steadyrest with spring-operated jaws that allow the barrel to float.

The turret of the machine contains ten tool-spindles, each fitted with a tool adapter which includes a nut and lock-nut that can be adjusted to gage the depth the tool is fed into the barrel.

The complete turret is adjustable along the bed and is clamped in one position to suit the job. After the work-spindle has been started, all succeeding operations are controlled by the capstan type wheel. As the operator turns the handwheel at the start of the operation, the uppermost tool spindle, which is in line with the work-spindle, feeds forward, and the first chambering operation is performed. Upon the withdrawal of this spindle, the turret indexes the next spindle into line and the second operation proceeds. The ten tools working successively complete the chamber.

The work-spindle is driven by V-belts from a variable-speed unit. A device employing cam control of the variable-speed drive unit automatically engages the correct work-spindle speed as each tool-spindle is brought into the working position.

This machine has a swing over the bed of about 20 inches and is made in two lengths to handle work 30 and 50 inches in length with gun bores up to 5/8 inch in diameter. The machine for handling work 50 inches in length requires a floor space 134 by 38 1/2 inches and weighs 4350 pounds. 51

LeBlond Multi-Cut Lathes

Two new Multi-Cut lathes of 6- and 9-inch capacities have been brought out by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Both lathes are designed to facilitate the set-up of separate tools for turning, facing, necking, and grooving cuts. All of the tools go through their respective cycles and complete their work simultaneously. The operation is automatic from the time the work is put into the lathe, the leading tool brought up to the work, and the power feed lever engaged. At the end of the cycle of cuts, the handwheel is used to return the tools to their proper positions for machining the next piece of work.

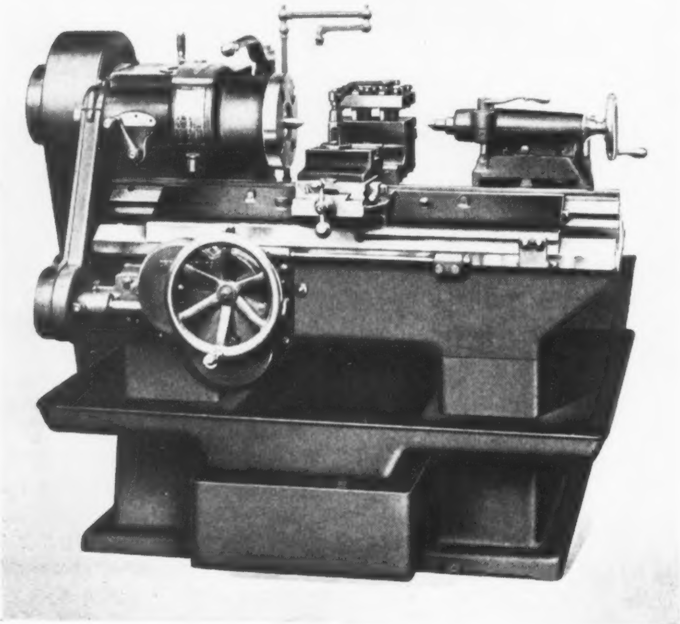
The variation in feed required for turning and facing is obtained by change-gears applied to the feed bracket and worm-drive box. The feeds read to 0.001 inch per revolution of the spindle.

A simple direct-reading work diagram shows the change-gear combinations and the resulting feeds. The relationship between the slides is quickly adjusted by the setting of the movable profile swivel-plate. As the facing or forming tools approach the end of the cut, the feed is retarded and stopped as the roller slides on the land of the profile guide plate. 52

Doall Surface Grinder

A Model GP Doall precision surface grinder built for production use is being placed on the market by Continental Machines, Inc., 1301 Washington Ave. S., Minneapolis, Minn. The base of this machine weighs 815 pounds and is designed to give maximum rigidity. The ball-bearing wheel-spindle is direct-driven by an accurately balanced motor.

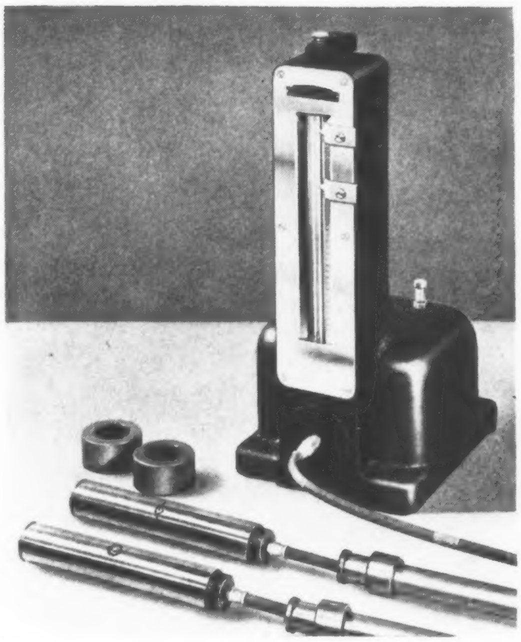
Both the longitudinal and crosswise table movements are obtained hydraulically. Simplified controls facilitate operation. A built-in dial indicator registering to 0.0001 inch facilitates accurate feeding with the handwheel. The rate of table travel can be varied from 0 to 50 feet per minute. The cross-feed is variable from 0 to 0.150 inch at each reversal of the table travel. Automatic cross-feed is provided for wheel dressing. A built-in fluorescent type lamp provides suitable illumination for the work-table. 53



LeBlond Multi-Cut Lathe Built in 6- and 9-inch Capacities

Doall Precision Surface Grinder

To obtain additional information on equipment described on this page, see lower part of page 160.



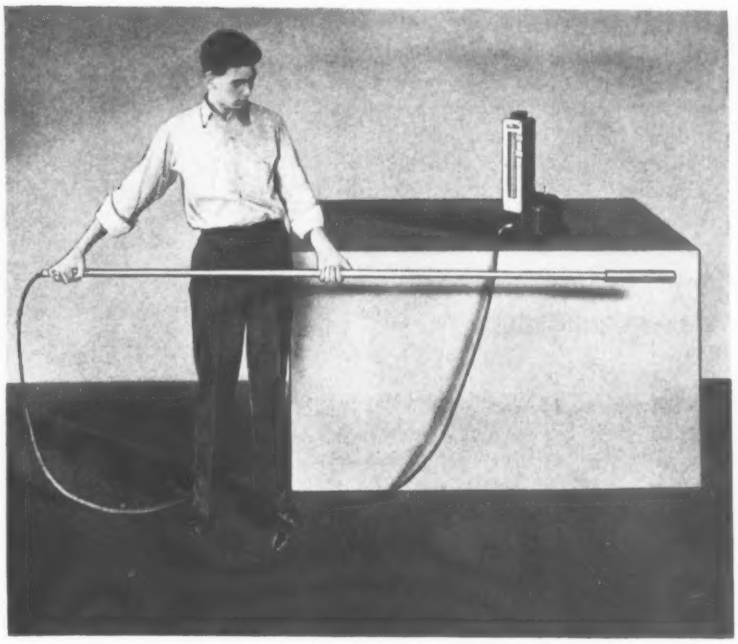


Fig. 1. (Left) "Precisionaire" Gun-bore Gage, Gaging Noses, and Minimum and Maximum Diameter Master Rings Used in Setting Tolerance Markers on Gage. Fig. 2. (Right) "Precisionaire" Equipment for Checking Gun Bore

Sheffield "Precisionaire" Gun-Bore Gage

A new type of gage designed especially for the precise checking of gun bores from the smallest rifle bore to the largest naval gun bore has been developed by the Sheffield Gage Corporation, Dayton, Ohio. This gage, designated the "Precisionaire," is of the flow type, its operation being based on variations in the flow or volume of air at constant pressure flowing between the gaging nose and the sides of the bore being gaged. Compressed air from the regular plant supply is used.

The gage checks the diameter of bores of any length and caliber, as well as the diameter of the rifling grooves in gun barrels. It not only measures the diameter of a bore to a high degree of precision, but also indicates the location and the amount of any out-of-round, taper, or bell-mouthed condition. It permits the gaging of every increment of length throughout the bore without the necessity of taking a series of separate readings.

Measurements of the average diameter (or equivalent circumference) can also be made at any desired position. Thus, it is especially adapted for use in cases where measurement of the inner circumference of a bore is more practical than measurement of its diameter; for example, a thin-walled easily distorted bushing which is eventually to be pressed into a rigid casting can be accurately and easily measured.

The equipment consists of a gage nose and handle, an air velocity indicator, and a connecting length of rubber tube. The gage nose may take any one of several forms, depending upon the nature of the inspection operation. Essentially, it is a cylindrical plug with a central air channel which terminates in one or more jets in the side of the cylinder just back of the forward end. When actual diameters, out-of-round, taper, or bell-mouthed conditions are to be checked, a nose is used which has two jets located diametrally opposite on the cylinder surface. When the average diameter (or equivalent circumference) is checked, the jets terminate in an annular groove.

The gage is made in two models. Model A, which is applicable to heavy or poorly balanced work parts and parts that must be gaged on the cutting machine, is constructed so that it may be presented to the work. Model B, which is used for work that is well balanced and light enough to handle, is constructed so that the work may be presented to it.

With the air pressure on, a minimum master ring is slipped over the gage nose, and the air pressure is adjusted so that the indicator float will rise to a point somewhat above the bottom of the transparent indicator tube, and one of the sliding marker points is set opposite the float position. When the maximum master ring is substituted for the minimum ring, the added velocity of air movement due to greater clearance sends the float to a higher position, and this is marked with the other sliding point. The length of the tube between these two indicator points represents the difference in diameter between the maximum and minimum master rings, or the tolerance of the work to be gaged, and this can be scaled for actual measurement if desired.

In use, the gage nose is passed through the bore in one continuous pass; and because of the flexible construction between nose and handle, the nose actually aligns itself. Any variation in bore diameter will cause the indicator float to change its position; this variation is shown on the indicator scale. In checking rifling grooves, a nose is used which has jets that terminate in bosses raised above the surface of the nose cylinder. The nose is inserted into the bore so that the bosses enter the rifling grooves; and as the nose passes through the bore, the bosses follow in these grooves. Successive passes check each pair of grooves.

The Precisionaire gage does not utilize contacting fingers or hard gaging points. However, the gaging nose may be equipped with bronze or silver rings as a protection against surface damage. 54

New Design of General Electric Ignitron Tubes

Ignitron tubes for resistance welder control have been redesigned by the General Electric Co., Schenectady, N. Y. The new designs are

To obtain additional information on equipment described on this page, see lower part of page 160.

provided with both inner and outer jackets of stainless steel, so that they are completely corrosion-resistant. These tubes are particularly adapted to welder control service because of their ability to carry very high peak currents over short periods. 55

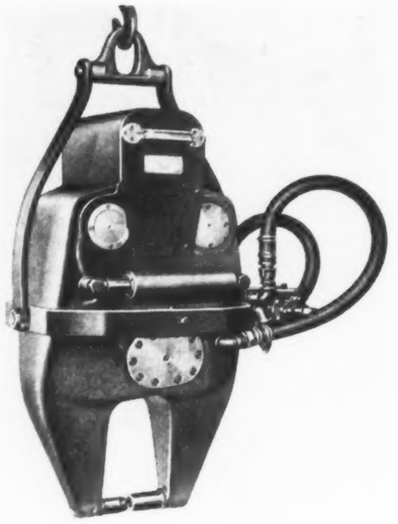


Fig. 1. Hanna Squeeze Riveter of the "Nut Cracker" Type

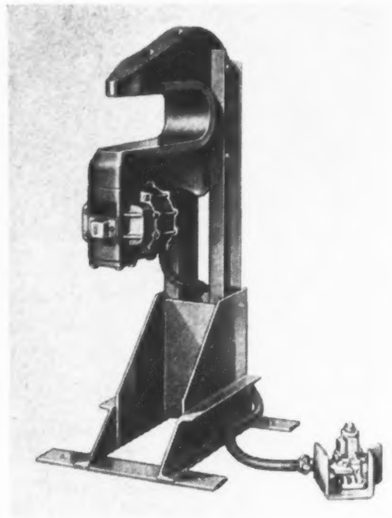


Fig. 2. Stationary Squeeze Riveter for Aircraft Assembly Work

Hanna Squeeze Riveters

A recent addition to the line manufactured by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., is a squeeze riveter of the "nut cracker" type which is designed for use where both the driving jaw and stationary jaw must enter restricted areas to drive rivets. During the initial part of the stroke, when little, if any, work is done on the rivet, the driving jaw moves forward rapidly with relatively low power consumption. The mechanism then automatically applies pressure on the rivet at the rated tonnage until the control valve is released. This permits the rivet to flow and fill the hole, the forming of the rivet head following automatically.

The riveter shown in Fig. 1 has a 15-inch reach, a 9-inch gap, and exerts a force of 50 tons on the rivet when operated at 100 pounds per square inch air pressure. It is available for other pressures, reaches, etc., to meet individual requirements.

The stationary type pneumatic squeeze riveter shown in Fig. 2 is another recent addition to the Hanna line. This machine is designed primarily for aircraft assembly riveting. It has a 20-inch reach, 6 1/2 inch gap, is capable of exerting ten tons pressure on a rivet at 80 pounds air pressure, and is recommended for driving 1/4-inch diameter aluminum alloy rivets, although it is available in a variety of sizes.

The ram is actuated by a pneumatically operated mechanism of the wedge and roller type. The rated pressure of the riveter is exerted through a considerable portion of the 1 1/2-inch ram travel. The long ram stroke eliminates the necessity for removing dies in order to pass the anvils over assembled parts.

The complete mechanism is demountable and permits modifications in the yokes or frames to suit different jobs. Spring action is employed to return the piston, in order to effect economies in air consumption. The riveter is actuated by a foot-operated valve. 56

Jones & Lamson Vertical Optical Comparator

A new vertical optical comparator has recently been added to the line of comparators made by the Jones & Lamson Machine Co., Springfield, Vt. The new machine is of all-metal rugged construction and is suitable for either laboratory or shop use. A 3 1/4-inch diameter glass disk on which objects can be staged for projection is set in the 8- by 7-inch object-staging table, central with the condensing and projecting lenses.

A substantial, 8-inch diameter, ground and lapped mirror, coated with aluminum oxide, reflects the object shadow on a 14-inch diameter receiving screen. This screen is located in a convenient position for studying the shadow outline. The machine is adapted for checking small flat objects which can be laid directly on the glass stage so that the enlarged shadow of the contour can be compared with an outline on the screen. The table slides are made of hardened steel, and the 5/16-inch diameter balls that support and guide the slides operate in accurately ground V-ways. This table will measure up to 2 inches sidewise and 1 inch backward or forward. It can be equipped with micrometers graduated to read 0.0005 or 0.0001 inch. Seven projection lenses are available which cover a magnification range of from six to one hundred times. 57

Fig. 1. Optical Comparator Brought out by the Jones & Lamson Machine Co.

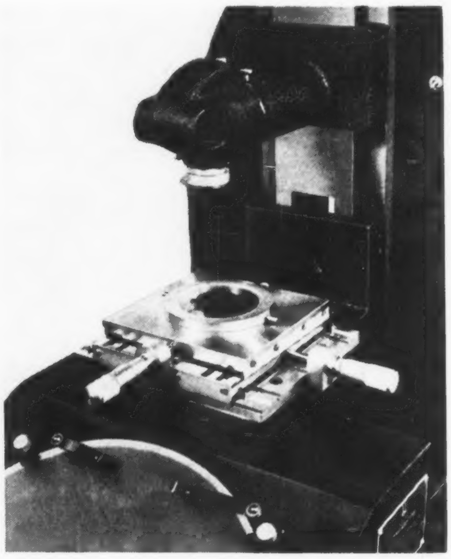


Fig. 2. Object-staging Table Equipped with Micrometers for Making Coordinate Measurements on Comparator

To obtain additional information on equipment described on this page, see lower part of page 160.

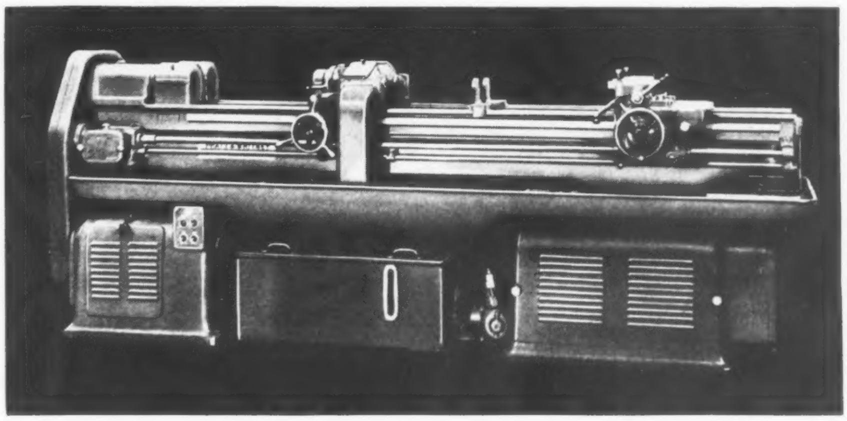


Fig. 1. Pratt & Whitney Deep-hole Drilling Machine

Pratt & Whitney Drilling and Reaming Machines for Deep-Hole Work

The two-spindle deep-hole drilling machine shown in Fig. 1, recently brought out by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., is designed for handling a wide range of work including rifle barrels, automotive connecting-rods, hollow spindles, wrist-pins, boring-bars, printing press rolls, stay-bolts, crankshafts, camshafts, etc. The single-flute deep-hole drill used in this machine remains stationary while the work revolves around it. Oil under high pressure, carried through a hole extending the entire length of the drill, blows the chips away from the cutting edge and out through an external flute.

Separate motors drive each spindle, permitting the operator to reload and start one spindle while the other is drilling. This machine is made in two sizes; the 1/2B machine for drilling holes from 3/16 to 5/8 inch in diameter and the 1B machine for drilling holes from 1/2 to 1 inch in diameter. The smaller machine is made in two lengths for handling work 30 and 50 inches long, while the larger machine is made in lengths to handle work up to 50 and 74 inches long. The smaller machine will swing work 8 inches in diameter and the larger machine will swing work 9 inches in diameter over the bed. Any four feeds within a range of from 0.0002 to 0.0018 inch per revolution of the spindle can be provided. The small machine for handling work up to 50 inches in length is 193 inches long, 33 inches wide, and weighs 6600 pounds. The larger machine for handling work up to 74 inches in length is 244 inches long, 36 inches wide, and weighs 8640 pounds.

A still larger deep-hole drilling machine, designated as No. 1 1/2, is being built by the same company for drilling long, true holes up to 2 inches in diameter. This machine has separate 5-H.P. motors mounted on top of the headstock for driving the work-spindles through gears, and also for supplying the power for feeding the drills. Change-gears provide the necessary speeds and feeds to suit the job. High-pressure oil pumps mounted on the drill feeding slides are driven by gears that slide on long shafts connected to a 7 1/2-H.P. motor mounted at the end of the bed.

The drill carriage has both hand and power feeds with knock-off stops. There is also an adjustable automatic knock-off, operated by the twist of the drill, which guards against overloads resulting from dull drills, hard spots in the work, etc. This machine will drill holes from 1 to 2 inches in diameter and is made in four lengths for drilling work up to 37, 61, 81, and 105 inches long, respectively. The swing over the bed will accommodate work 11 inches in diameter. The machine for drilling work up to 37 inches in length requires a floor space 246 by 57 1/2 inches and weighs 10,000 pounds. The machine for handling work up to 105 inches in length requires a floor space 390 inches long by 57 1/2 inches wide and weighs 16,070 pounds.

The new Pratt & Whitney reaming machine shown in Fig. 2 is designed primarily for reaming rifle barrels, but will also handle any other type of deep-hole reaming work within its range. Several new features have been provided to meet modern production requirements.

In operation, the work is held in a fixture on the carriage, this whole unit being fed toward or away from the rotating reamer. The smooth pull of the hydraulic feed and the even power from the V-belt driven ball-bearing spindle are designed to produce holes to meet the most exacting requirements of size and finish.

The hydraulic feed, infinitely variable from 2 to 10 inches per minute, permits the operator to vary the feed to obtain the most satisfactory results. Rapid-traverse return at 30 feet per minute and quick-acting fixtures for loading and unloading the work are features designed to increase production. The two reaming units are entirely separate, each having its individual spindle motor, hydraulic feed motor, and coolant pump. This enables the operator to reload or check work at one spindle while the other is in operation.

The 1/2B machine reams holes 3/16 to 5/8 inch in diameter and is made in two lengths to handle work 30 and 50 inches long, while the 1B machine will ream holes from 1/2 to 1 inch in diameter and is made in two lengths to handle work 50 and 74 inches long. 58

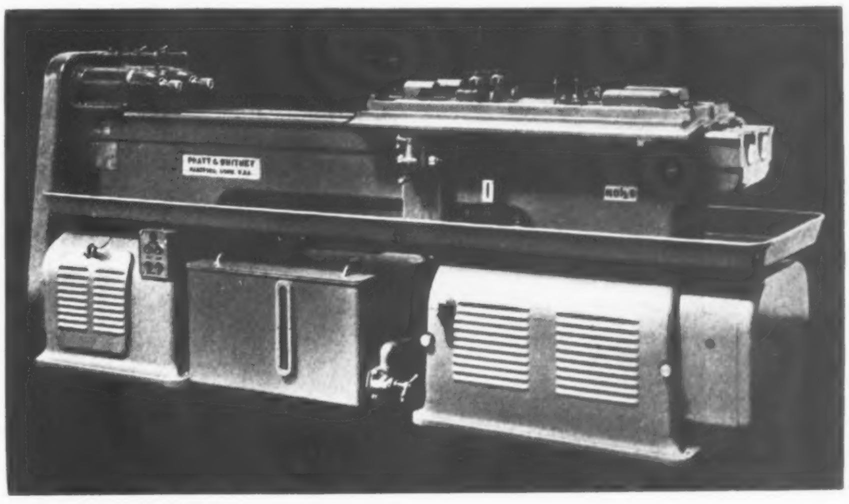
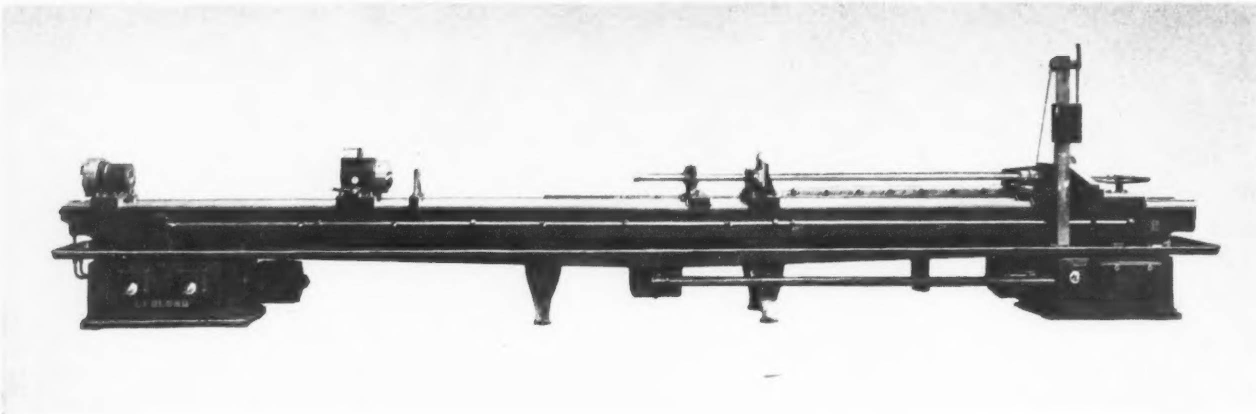


Fig. 2. Pratt & Whitney Deep-hole Reaming Machine

To obtain additional information on equipment described on this page, see lower part of page 160.



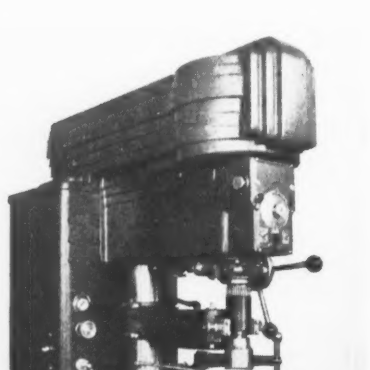
Gun Rifling Machine Built by the R. K. LeBlond Machine Tool Co.

LeBlond Gun Rifling Machine

Simplicity of design and operation are outstanding features of the new No. 2 gun rifling machine brought out by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine is built for rifling guns with bores up to 3 inches in diameter and lengths up to 88 inches. Either the gun or the tool-bar of the machine can be easily indexed. The grooves can be either cut or broached. Adjustable automatic stops control the movement of the carriage, which stops at the end of each stroke. The carriage can be given any length of travel up to 10 feet.

Two manually operated levers are conveniently located on the control rod, which runs the full length of the bed and operates a four-way valve used to start and stop the carriage and reverse its direction of travel.

Power for operating the main hydraulic cylinder is furnished by a 5-H.P., constant-speed motor directly connected to a constant delivery vane type rotary pump. This pump has a capacity of 18 gallons per minute and will exert a maximum pressure of 600 pounds per square inch. 59



Bakewell Improved No. 2 Precision Tapping Machine

Bakewell Improved Precision Tapping Machine

An improved No. 2 precision tapping and threading machine, an earlier model of which was described on page 284 of December, 1939, MACHINERY, has recently been placed on the market by the Bakewell Mfg. Co., 2427 E. 14th St., Los Angeles, Calif. Improvements have been incorporated in this machine to insure the maintenance of Class 3 and Class 4 fits. Continued maintenance of these fits is assured by the use of two bronze lead fingers which are rethreaded for each new lead by hobbing flutes provided at the top of each lead-screw. Constant tension against the lead-screw is effected by means of a solenoid-operated toggle mechanism that prevents lost motion due to wear. The use of bronze lead fingers reduces to a negligible amount the wear on the hardened lead-screw. Upper and lower limit switches control the movement of the spindle and the threading depth, which can be held to an accuracy of 0.008 inch.

A specially designed clutch of the plate type is adjustable to the torque strength of the tap and will slip before the tap breaks. The proper tension for safe torque resistance is maintained by hydraulic pressure. Should an obstruction require retraction of the tap, its re-entry can be made without injuring the thread, as the relative positions of tap and work-piece threads remain unchanged as long as the work remains fixed on the table. Left-hand threads can be cut with the same facility and accuracy as right-hand threads. External threads can also be cut if a suitable die-holder and die are used.

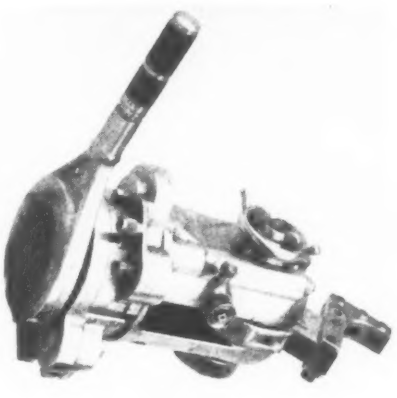
The No. 2 machine has a tapping capacity of 3/8- to 2-inch pipe threads in aluminum, fiber, plastics, etc.; 3/8- to 1 1/4-inch pipe threads in steel, including nickel and chromium-alloy normalized steels; and 3/8- to 1 1/2-inch straight threads in nickel and chromium-molybdenum normalized steels. 60

Sarco Temperature Control for Degreasing

The Sarco Co., Inc., 183 Madison Ave., New York City, has recently added to its line of self-operated temperature regulators a new instrument known as the Sarco vapor-line control. This device has been designed specifically to control the heating medium on degreasers used in metal manufacturing and finishing plants to clean screw machine and other metal parts preparatory to plating or to remove machine lubricants, etc.

The control is available in sizes from 1/2 inch to 2 inches for temperatures up to 400 degrees F. It can be adjusted to maintain the correct gas or steam heat required for vaporizing trichlorethylene or other solvent in which the parts are cleaned. 61

To obtain additional information on equipment described on this page, see lower part of page 160.



Universal Machine Head Placed on the Market by John Kis

Universal Machine Head

The universal machine head here illustrated is being placed on the market by John Kis, 2028 Phillips Ave., Racine, Wis. This equipment is threaded for mounting on the spindle of any machine tool, adapters being used, when necessary, for mounting the head on horizontal boring-bars and the spindles of machines such as vertical mills or jig borers. It is adapted for taper-boring, taper-turning, facing, back-facing, beveling, grooving, radius-boring, straight boring, counterboring, under-cutting, turning, and recessing. In all of these operations, the work, regardless of its size, remains stationary and the head revolves with the machine spindle.

The pivoting, sliding, and revolving motions which can be imparted to the cutting tool are determined by the set-up. The head can be used advantageously for boring operations on fixtures and for taking facing cuts on turret heads. Fixtures can be faced, bored, counterbored, etc., in accurate alignment with the spindle after being attached to the machines on which they are to be used.

The feed of the head is independent of that of the machine on which it is mounted, the motion of the sliding bar being obtained through the gearing encased in the head. The only mechanism that remains stationary is the operating handle used to stop or release the sliding bar A simple twisting motion of the operating handle in a counter-clockwise direction serves to stop the cutting feed without stopping the machine spindle. This prevents the tool from digging in and damaging the work. If further cutting is desired, the operating handle is simply twisted in a clockwise direction. With this arrangement, the work can be cut to size within 0.001 inch and a sharp corner can be produced. The machine head is equipped with a handwheel for rapid movement of the sliding bar. A thumb-nut in the wheel releases and locks the clutch and bar. Several tool-holders are supplied for handling different kinds of work, and two bars are furnished to accommodate small and large jobs.

The head is equipped with a forward and reverse bar feed and a safety forward stop. There are two different feeds per revolution of the bar which has a 5-inch stroke, giving a capacity for boring holes up to 10 inches in diameter. There is a radius feed and a vernier for a 360-degree swivel for the different work angles. The vernier is capable of reading up to 5 minutes. Readings beyond these limits require an indicator. Provision is made for employing an indicator for boring accurate tapers. 62

Hannifin Automatic Shell-Marking Press

Hydraulic presses designed for the rapid marking of 75-millimeter shell casings in an automatic cycle of approximately four seconds have recently been placed on the market by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. The capacity of the press shown in the accompanying illustration is 20 tons. A 10-ton model of similar design is also available.

The ram is fitted with a marking die, and when once started operates continuously, with automatic reversal at the top and bottom of the stroke. Reversal at the bottom of the stroke occurs automatically when maximum pressure is exerted on the die, a feature which insures uniform marking. Both the pressure and the ram stroke are adjustable.

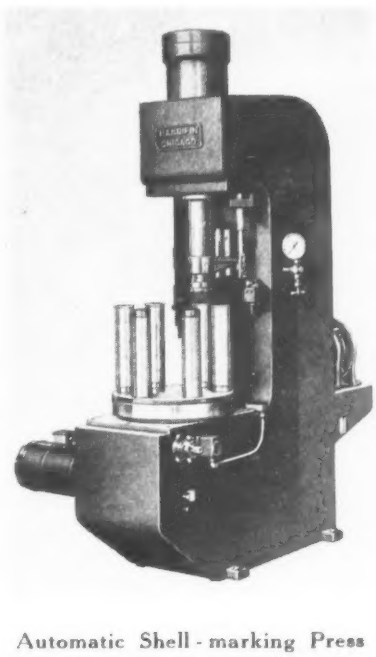
The circular table is equipped with six mandrels. The table-indexing mechanism runs in oil, and is driven by a 3/4-H.P. motor with electric brake, which is automatically controlled to advance the table position with each return stroke of the ram. The operator has only to start the press and load and unload the fixture as the table advances. The press will operate at a maximum rate of 15 cycles per minute.

A motor-driven hydraulic power unit is built into the rear of the press, so that the equipment requires only electrical connections to complete the installation. The press frame, table support, and power unit mounting are of welded steel.

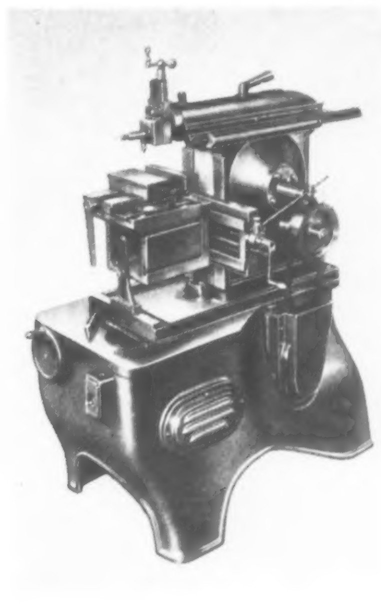
Although designed primarily for marking shells, this press is also adapted for other operations. 63

Precision Shaper with Stepless Speed Control

A precision shaper with rigid pedestal base designed to give the operator foot room for working close to the machine has been developed



Automatic Shell-marking Press Brought out by Hannifin Mfg. Co.



Precision Shaper Developed by the Machinery Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 160.

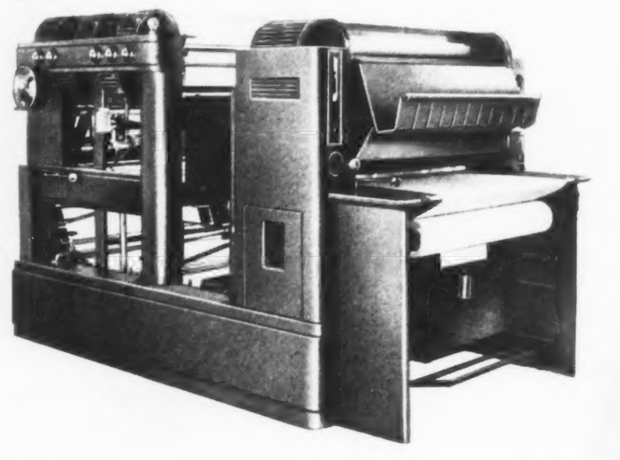
by the Machinery Mfg. Co., 1915 51st St., Vernon, Los Angeles, Calif. A new feature is the addition of a handwheel on the front of the pedestal which permits a smooth, stepless change of motor speeds. The motor and hanging base mountings are cast integrally with the pedestal to assure correct alignment. The removable louvre side plates provide proper motor ventilation and easy access to the interior. The shaper has a maximum stroke of 11 1/4 inches. The ram length is 21 inches, and 50 to 150 strokes per minute are provided by variable speeds. The entire assembly requires a floor space of only 24 inches by 36 inches. 64

Universal Slotting Head

A universal slotting head for precision work, designed for use on all types of milling machines, has been placed on the market by the Special Machine Division of the Experimental Tool & Die Co., 12605 Greiner Ave., Detroit, Mich. The stroke of the ram can be quickly and accurately adjusted from 0 to 4 inches. The head is equipped with a 1/4-H.P. motor which provides four speed changes ranging from 50 to 250 or from 100 to 580 strokes per minute. The toolholder is of the clapper-box type and can be turned to any position desired.

The streamline housing is of polished cast aluminum, and all working parts are made of steel, heat-treated and ground. Preloaded Timken bearings are used throughout, and the gears are hardened and ground. This slotter can be used for cutting keyways, templets, splines, and internal gears, and for slotting out precision blanking dies or for any work requiring the machining of sharp corners and special shapes.

The over-all dimensions are length 18 inches; width, 8 inches; and depth 12 inches. It is supplied complete with pulleys, motor, and a mounting adapter to suit the milling machine on which it is to be used. 65



Pease Continuous Blueprinting, Washing, Developing and Drying Machine

Pease Blueprinting Machine

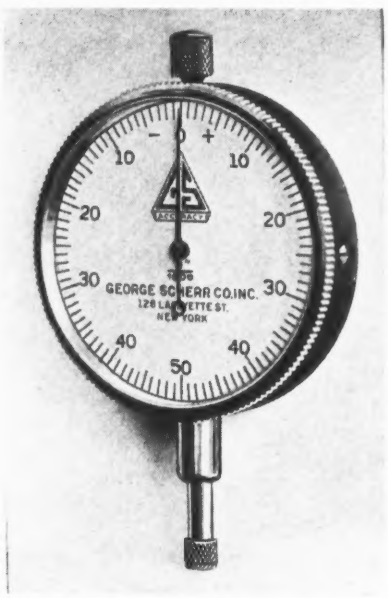
The Model 22-16 continuous blueprinting machine here illustrated is the latest addition to the line made by the C. F. Pease Co., 2601 W. Irving Park Road, Chicago, Ill. This machine has been developed to meet the needs of commercial blueprinters, industrial plants, and government departments whose production requirements do not necessitate the high speed of the Model 22 but who do want the features incorporated in the latter machine. The 22-16 machine consists of a Model 22 printer used in conjunction with a Model 16 washing and drying machine.

Outstanding features include sliding contact, which smooths out all inequalities present in tracings and gives 24 3/4 inches of uninterrupted exposure area; three-speed lamp control, which allows the lamps to be operated at 10, 15, or 20 amperes, as desired; and actinic arc lamps which furnish uniform light emission. 66

Scherr Dial Test Indicator

A new dial test indicator with simplified lever movement has been brought out by the George Scherr Co., 128 Lafayette St., New York City. Constructed with the idea that the simpler the mechanism, the greater the accuracy and durability of the tool, the GS indicator utilizes a lever movement instead of the usual rotating multiple gear and pinion trains. The indicator movement is mounted between separate top and bottom plates, while the hair spring is placed between two flat plates and cannot interfere with the lever rack. The plunger is hardened and ground and has nickel-silver bearings. The dial is graduated in thousandths of an inch, and the plunger travel is 3/16 inch. The indicator can be supplied with a universal ball joint back, which permits a wide range of settings on all types of machines. 67

Universal Slotting Head Placed on the Market by the Experimental Tool & Die Co.

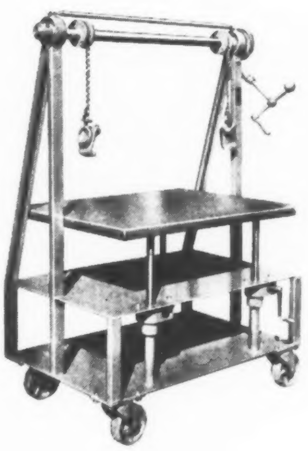


Dial Test Indicator with Simplified Lever Movement Brought out by George Scherr Co.

Johnson "Multiduty" Die Truck

The O. Johnson Co., Brookfield, Ill., has brought out a new and improved "Multiduty" die truck in two sizes,

To obtain additional information on equipment described on this page, see lower part of page 160.



"Multiduty" Die Truck Built by O. Johnson Co.

having capacities for handling dies up to 40 and 32 inches long. The over-all dimensions of the larger size truck are: Length, 44 inches; width, 28 inches; height, 66 inches. The table is 28 by 40 inches, and the maximum and minimum heights of the table from the floor are 40 and 24 inches, respectively. The safe table load is 3000 pounds, and the safe overhead load, 1600 pounds. The swing between the table and the overhead shaft, with the table up, is 24 inches, and with the table down, 38 inches. The shipping weight of the larger machine is 450 pounds.

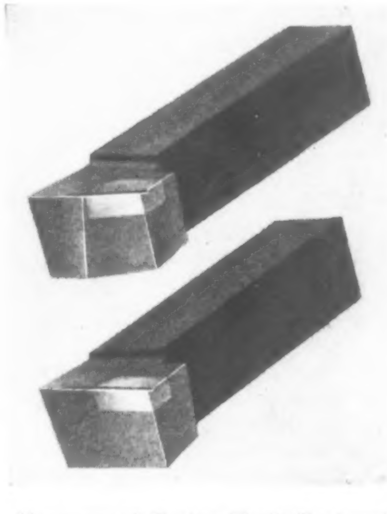
The over-all dimensions of the smaller die truck are: Length, 36 inches; width, 24 inches, height, 66 inches. The table is 24 by 32 inches. The safe load on the table is 2000 pounds, and the safe overhead load is 1600 pounds. The shipping weight of the smaller machine is 375 pounds. These die trucks are of electrically welded construction and have roller-bearing, heavy-duty casters, and enclosed gears. 68

Westinghouse Ball-Bearing Induction Motor

A sleeve-bearing, squirrel-cage, induction motor designed for general-purpose drive applications on machine tools, pumps, auxiliary drives, etc., brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was illustrated and described in January MACHINERY, page 220. The company has now brought out a line of motors of the same design and capacities, but provided with "permanently sealed" ball bearings which require lubrication only once every three years. Through the use of the double-row bearing width, a 50 per cent increase in shaft contact area is obtained, with consequent longer bearing life and reduced shaft wear. 69

McKenna Facing Tools for Turret Lathes

Two new styles of tools designed for facing operations in turret lathes have just been added to the standard line of Kennametal tools made by the McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., for machining steel and other metals. The new tools, known as Style Nos. 21 and 22, have 6-degree side and front clearance angles, 8-degree end cutting edge angles, and 6-degree side rake and 2-degree negative back rake angles.



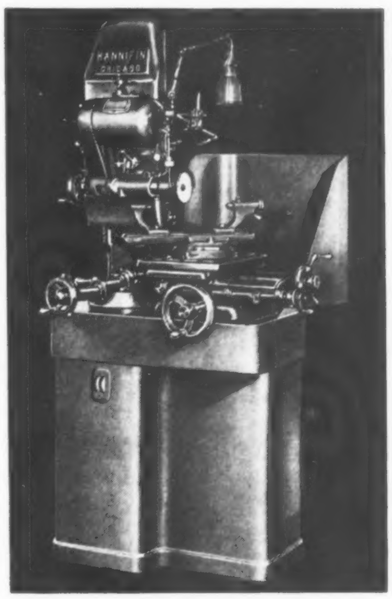
Kennametal Facing Tools Designed for Use in Turret Lathes

The Style No. 21 tool, shown in the upper view of the illustration, has a 20-degree side cutting edge angle and is intended for use where a 90-degree shoulder on the work is not required. The Style No. 22 tool, which has a zero side cutting edge angle, is for use in facing to a 90-degree shoulder.

The non-galling action of the Kennametal tip permits the negative rake angle to be employed to advantage. This feature has the effect of imparting greater strength to the carbide tip. These tools are supplied with chip-breakers, the tool shown in the upper view having a groove type chip-breaker ground parallel to the side cutting edge, while the tool shown in the lower view has a shelf type chip-breaker ground at an angle of 5 degrees. 70

Hannifin Universal Precision Tool Grinder

Strength, rigidity, ease of handling, and accuracy are features claimed for a universal precision tool grinder recently brought out by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. The grinding wheel spindle is especially designed to protect the bearings from grit and coolant. The spindle is driven by a balanced, heavy-duty, 3/4-H.P. universal motor with built-in air filter and forced ventilation system. The drive is through an endless belt, and interchangeable pulleys provide ten spindle speeds ranging from 3600 to 35,000 R.P.M. under load.



Universal Precision Tool Grinder Brought out by the Hannifin Mfg. Co.

The spindle carriage and table slides are all manually operated, with both rapid traverse and micrometer feed. For greater accuracy, fine-pitch lead-screws are used with large-diameter dials that permit accurate settings. Wheels are mounted with hardened and ground adapters to insure accurate replacements. A plain angle-wheel dresser and sub-table with centers are furnished as standard equipment.

Other fixtures also available include a combination dividing head and cylindrical grinding attachment, which is furnished with or without a motor drive; a radius and angle wheel-dresser; a radius extension for half-circles; a formed cutter fixture; a back-off and relieving fixture; a universal vise; a spiral grinding fix-

To obtain additional information on equipment described on this page, see lower part of page 160.

ture; and a master spiral finger arm with spring roller.

The carriage has a vertical travel of 7 1/2 inches with rack feed and 9 1/2 inches with micrometer feed; a longitudinal table travel of 5 1/2 inches with rack feed and 2 inches with micrometer feed; and a transverse table travel of 5 1/2 inches with rack feed and 2 inches with micrometer feed. The table working surface is 9 by 13 inches. The main column adjustment about the vertical axis is 15 degrees on each side of the parallel setting, and the distance between the table and the center of the spindle is 12 inches. In addition to the grinding of standard or special cutting tools, this machine can be used for grinding fixtures, gages, dies, etc. 71

Leeds & Northrup Temperature Indicator

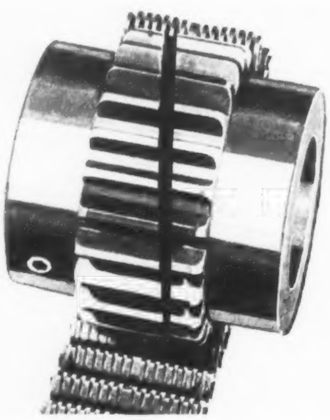
The Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., has brought out a new portable instrument for thermo-couple temperature measurements, for checking thermocouples, or for measuring small electromotive forces. Greater precision is obtained with this new instrument without increasing its cost by sacrificing the convenience of a reference-junction compensator. Increased accuracy is obtained by calibrating only a small portion of the range on a continuously adjustable slide wire. The remainder is adjustable in fixed steps on a dial switch of ten highly accurate resistors. The range covered by the indicator is from 0 to 111 millivolts with a limit of error of plus or minus 0.1 millivolt.

This instrument is completely self-contained, and no additional accessories are required except the thermocouple and an ice bath for the reference-junction. Coarse and fine battery rheostats, pointer galvanometer, standard cell, battery galvanometer key and standardizing key are built into the potentiometer. The oak case of this instrument is 12 1/4 by 7 3/4 by 7 7/8 inches in size, and is provided with a hinged lid and carrying handle. 72

L. & N. Temperature Indicator which can be Used for Measuring Small Electromotive Forces

Ramsey Chain Coupling

A new Type D flexible chain coupling designed to eliminate shearing of the pins in the chain has been brought out by the Ramsey Chain Co., Inc., Albany, N. Y. The new pinions of the coupling, instead of having straight sides, are cut diagonally as shown in the illustration, so that one pinion pulls the other through the full width of the chain. With this arrangement, wear on the teeth due to excessive misalignment is distributed evenly across the entire face of both pinions. 73



Ramsey Chain Type Flexible Coupling

Cal-Ku-Scope Triangulation Instrument

A geometric instrument for solving mathematical problems involving triangulation has been developed by Cal-Ku-Scope, Inc., Suite 520, 233 Broadway, New York. This device is composed of two cross members, each consisting of two parts which act in conjunction with each other. There are two side members which are pivotally and slidably connected to the cross members.

The cross members are supplied at the corners with protractors and verniers to determine angles. They are also graduated along their lengths and equipped with verniers to determine lengths or distances, which can be read to 0.001 inch. The two side members are supplied with graduated scales and verniers located at the intersection of one of the cross members. These permit determining lengths or distances to 0.001 inch.

Cal-Ku-Scope Designed for Use in the Solution of Mathematical Problems

In addition, there are two auxiliary members which are used for determining distances across corners, radii, length of base, altitude, etc. One of these two auxiliary members is pivoted to one end of one of the side members and the other is connected to the first-mentioned auxiliary member.

The protractors located at the four corners of the instrument permit reading to five minutes. The instrument can be supplied in a model which is accurate to 0.0001 inch in length and is equipped to read in degrees, minutes, and seconds. It can also be furnished with metric system graduations. In order to solve a triangulation problem on the Cal-Ku-Scope, it is only necessary to set up the given elements of the problem on the instrument and the desired unknown factors can be read directly from scale readings. It can be applied in solving mechanical engineering, toolmaking, and machine designing problems, and problems of marine and air navigation, surveying, artillery range plotting, construction, and electrical engineering. 74

Link-Belt Variable-Speed Test Rig

In the process of adapting the P.I.V. gear variable-speed transmission to a variety of services, the Link-Belt Co., Philadelphia, Pa., has developed a compact, fully enclosed, variable-speed test rig which combines the basic P.I.V. unit and an adjustable mounting bracket on a rigid welded-steel base. Among the

To obtain additional information on equipment described on this page, see lower part of page 160.

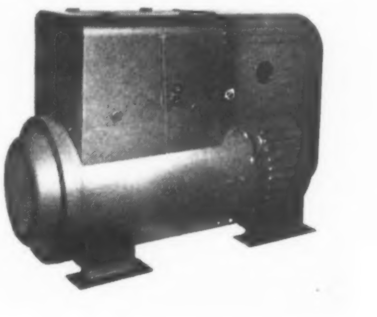
many uses found for this equipment are the testing of generators, magnetos, governors, vibrators, pumps, springs, sewing machines, bearings, etc.

The tests usually are made for determining whether the equipment tested runs true, functions efficiently, carries the load properly, and for calibrating. Among the applications for which the equipment has already been adapted may be mentioned the testing of fuel pumps, radio generators, and tachometers in aircraft manufacture, and the testing of control governors of Diesel railway motors. 75

Reliance Adjustable-Speed Drives

An extension in the range of sizes of the Type V-S all-electric, alternating-current, adjustable-speed drive has been made by the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio, to include three additional units of 20, 25, and 30 H.P. In the new sizes the central unit is mounted horizontally instead of vertically, which provides greater compactness. The mounting brackets are equipped with longitudinal rubber shock pads to insure quiet operation of the unit. No special foundation or leveling is required. The unit operates from a three-phase, 60-cycle, alternating-current power supply, which may be 220, 440, or 550 volts. The driving motor is a Reliance Type T, designed particularly for adjustable speed service, and is connected with the driven machine by direct drive. The speed adjuster—no larger than an ordinary plate rheostat—and the start-and-stop pushbuttons can be located in any convenient position on the machine to be controlled.

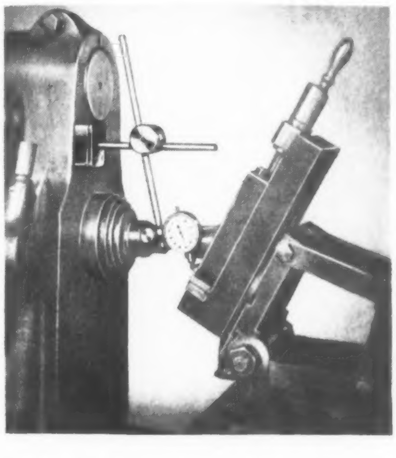
Starting and stopping are accomplished without interfering with speed settings, and quick stopping is obtained by regenerative braking. Speed changes can be made while the driving motor is in operation. The speed range is 16 to 1 for continuous duty, with a greater range possible for intermittent duty. 76



Reliance Adjustable-speed Drive with Main Control Unit Mounted Horizontally

Mellaphone Magnetic Base for Indicator

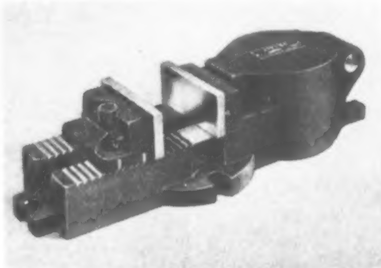
A new type of dial indicator base constructed of the powerful magnetic alloy "Alnico" has been placed on the market by the Mellaphone Corporation, Rochester, N. Y. This magnetic base permits quick attachment to horizontal, vertical, or inclined steel or iron surfaces and is sufficiently powerful to support an indicator at the extreme end of the 3/8-inch diameter non-magnetic post attached to the base when mounted at any angle. It is claimed that the magnetic property of the base will remain for years without weakening and is unaffected by rough usage. 77



Mellaphone Magnetic Indicator Base in Use on Milling Machine

Airlox Quick-Acting Pneumatic Vise

An air-operated vise designed for production work on milling, planing, tapping, shaping, and drilling machines, as well as for bench and assembly work, has been brought out by Production Devices, Inc., 213 Comstock Bldg., East Hartford, Conn. A single-acting air piston and opposed cams exert a gripping force on the work that is ordinarily equivalent to forty-five times the air pressure, but provision can be made for higher or lower ratios of gripping pressure to air pressure.



Airlox Quick-acting Vise Made by Production Devices, Inc.

The automatic opening and closing movements of the vise jaws can be synchronized with the movement of the milling machine table at any given points in the table travel through a simple cam-operated valve. Spring, jig, and special jaws, used with foot, hand, cam, air or electrically operated valves, can be employed to speed up production. The maximum air consumption is 0.02 cubic foot per operation.

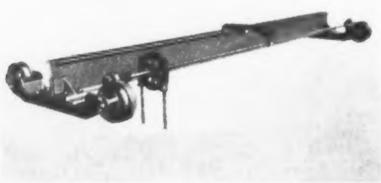
The self-truing jaw is instantly adjustable. Keyways provide accurate location for precision work, and there is a flange for mounting on a swivel base. The over-all dimensions are length, 20 inches; width, 7 inches; and height, 4 13/16 inches. The vise weighs approximately 55 pounds. The jaws are 5 inches wide by 2 1/2 inches deep and have a maximum opening of 5 inches. The jaw travel is 5/8 inch and is adjustable by 3/16-inch steps. 78

Kent-Owens Milling Machine

A No. 2-20 milling machine with a hydraulic table feed has been brought out by the Kent-Owens Machine Co., Toledo, Ohio. The new machine has a table 42 inches long by 12 inches wide, capable of 20-inch travel. It has a fully automatic cycle; the table can be fed or rapidly traversed in either direction; it can be automatically shifted from rapid traverse to feed in either direction, and automatically reversed at both ends of the stroke. It can also be automatically stopped at any point in its travel.

An unusual feature of the machine is that it permits independent adjustment of the feed rate for opposite directions of table travel. This makes it possible to perform one operation on a piece clamped at one end of the table and an entirely different operation on a piece at the other end. Each direction of table travel has a separate feed rate control dial with independent adjustment. 79

To obtain additional information on equipment described on this page, see lower part of page 160.



Top-running, Geared Type, Traveling Bridge Crane Built from "Budgit" Assembly

"Budgit" Crane Assemblies

A new line of equipment from which cranes of various types can be assembled has been placed on the market under the trade name "Budgit" by the Shaw-Box Crane & Hoist Division of Manning, Maxwell & Moore, Inc., Muskegon, Mich. Traveling bridge and jib cranes can be built by applying these assemblies to a standard section I-beam. A wrench is the only tool required to complete a crane when these assemblies are employed. No machine work or drilling of holes is necessary, and any of the various types of cranes made from these assemblies can be completed in an hour's time.

The top-running, geared type, traveling bridge crane shown in the accompanying illustration is built from one of these assemblies, which consists of all the parts required except the I-beam and shaft. Other assemblies are available for building jib and bridge cranes. 80

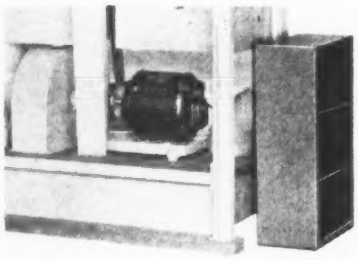
Drafto Model 60 Drafting Machine

The Drafto Co., 182 Walnut St., Cochranton, Pa., has brought out a new drafting machine known as the Master-Drafto No. 60, which takes sheets up to 24 by 36 inches. This machine is similar to the earlier models made in sizes to take paper sheets 12 by 18 and 15 by 20 inches, which were described in August, 1940, MACHINERY, page 143.

The machine is light in weight, easy to operate, and is built to withstand hard usage. A screw is provided for leveling the scales parallel to the drawing surface. The stainless-steel protractor plate can be set accurately for 1/2-degree readings by the use of the vernier. The protractor can be locked at any degree; but for speed and convenience, it is fitted with a latching spring for locking the scales at 0, 30, 45, 60, and 90 degrees on either side of the zero point. 81

Leiman Air Filter for Dust Collectors

A spun glass filter for the exhaust outlets of dust-collecting units, designed to provide maximum health protection against dust particles, has recently been introduced by Leiman Brothers, 101-F-5 Christie St., Newark, N. J. This filter insures that the air emerging from the dust-collecting equipment and re-entering the room or blowing outdoors will be as clean as it is possible to make it. Although developed primarily for installation with the polishing dust-collecting equipment built by this company, it is applicable to other types of dust collectors as well. One size measures 8 by 16 inches, and is 25 inches high. Larger units are also available. 82



Leiman Air Filter for Purifying Exhaust Air from Dust Collector

Worthington Quick-Adjustable Sheaves for V-Belts

A new V-belt driver sheave designated the Q-D quick-adjustable and quick-demountable type is being placed on the market by the Worthington Pump and Machinery Corporation, Harrison, N. J. This sheave is of simple construction, and can be quickly mounted on a shaft or removed. It is adapted for use in driving fans, blowers, printing presses, machine tools, and special equipment employed in various industries where speed ratios must be changed frequently to meet varying conditions.

Each sheave unit consists of two parts, a longitudinally split or clamped hub and a V-groove rim. The hub is clamped to the shaft by means of a cap-screw in its flange, and is securely fastened by a standard keyway. The rim is taper-fitted to the hub and is fastened with three draw-bolts. These sheaves are available in the complete range of standard driver sizes. 83

Solution for Industrial Skin Protection

The Milburn Co., 905 Henry St., Detroit, Mich., manufacturer of materials for skin protection in industry, has developed a new preparation known as Ply No. 9, intended for industries where perspiration of the hands is injurious to either the worker or the product. This new preparation finds application in the manufacture of high-precision bearings and airplane parts, where perspiration would cause rust spots. It is also applicable in connection with some of the new synthetic finishes that cause irritations resulting in skin troubles.

The new preparation is available in the form of a water-like, colorless solution in which the worker dips his hands, permitting it to dry on them. When dry, the solution forms a thin, invisible film that provides the required protection. 84

Combination Light and Magnifying Lens for Viewing Precision Work

The most recent addition to the "Magni-Master" line manufactured by Mizzy, Inc., 105 E. 16th St., New York City, consists of a lamp and magnifying lens combined in one unit, as shown in the accompanying illustration, for use in viewing precision work. The lamp has been developed to provide illumination duplicating daylight, under which the work can be viewed comfortably through a lens 35 millimeters in diameter which

"Magni-Master" Light and Magnifying Lens for Viewing Precision Work

To obtain additional information on equipment described on this page, see lower part of page 160.

has a magnification power of four and one-half times.

This equipment is available in hand units, stand units, or with special fittings. Each unit is equipped with ball-joint attachments and slides, which allows complete adjustability for any focussing or positioning. 85

Roan End-Mill Grinding Fixture

Roan End-mill Grinding Fixture in Use on High-speed Drill Press

A grinding fixture for end-mills, which can be used on a high-speed drill press as shown in the accompanying illustration, has been brought out by the Roan Mfg. Co., Racine, Wis. The grinding wheel supplied with the fixture has a precision-made arbor that fits a drill-press chuck of 3/8-inch capacity.

The grinding fixture will hold end-mills of the single- and double-end types, and straight- or tapered-shank end-mills with shanks of any diameter up to 1 inch. It can also be used for grinding hollow-mills, counterbores, and facing tools. The fixture is only 5 by 7 inches in size, and weighs 8 pounds. 86

Principles Involved in Powder Metallurgy

"Powder metallurgy" is a branch of metallurgical knowledge that is rapidly becoming more important, and is today finding many fields of application. It cannot be termed a wholly new method, since it has been in use for the production of ingot platinum for probably more than a hundred years; and it has also been the only possible method of producing tungsten in wire form for electric bulbs or X-ray tubes. The recent rapid advances of the process, however, have enabled the wider use of the method to be commercially realized, and much intensive effort is being expended on its development.

Powder metallurgy may be defined as the use of metal powders, with or without bonding agents, to produce articles by the application of pressure and heat. The method may be applied to single metals or to mixtures of two or more to form a sintered alloy; further, it is possible to incorporate non-metallic powders if so desired. The pressing operation may be carried out hot or cold. The sintering temperature is usually well below the melting point of the metal or metals concerned. The final product of powder metallurgy may be closely similar to that produced by the ordinary methods of casting and fabrication or it may have special features or properties unattainable by ordinary methods.

Some metallic powders are available in a high state of purity, particularly iron and nickel. The initial purity of the powder can be maintained during the manufacturing process, since the material is not required to be melted and there is no risk of its contamination with sulphur or oxygen; nor can there be any of the usual deficiencies of casting, such as non-metallic inclusions, blisters, and blow-holes.

By the use of metal powders, alloy compositions can be accurately controlled and bronzes and gun metals, for example, can be produced with an accuracy and uniformity unattainable by foundry methods. Segregation and its accompanying evils are, of course, entirely eliminated. Bi-metals such as nickel-iron and tungsten-copper can be produced in bars, the layers of which are perfectly welded together; the latter combination could hardly be produced at all by ordinary methods. Alloys having constituents that are widely different in melting point (and, therefore, cause difficulty in the foundry), can easily be produced by powder metallurgy. In this class, the lead-copper alloy which has such desirable bearing properties is important. The possibility of introducing non-metallic powders permits of producing materials with special characteristics, as for example, the copper and graphite mixture used for generator and motor brushes, and the well-known oil-less bearings, in which graphite is used in addition to copper and tin powders.

Materials having a high melting point, such as tungsten, molybdenum, and tantalum are so refractory to ordinary processes that powder metallurgy is practically the only method by which they can be made commercially available, and makes possible the incorporation of the thoria which gives the wire its "non-sag" characteristics when used for filaments.

The various forms of hard-cutting materials of the cemented-carbide type, owing to their high melting points and the necessity of providing a plastic bond, can also be produced most advantageously by the powder method.

It is possible by the control of particle size, pressure, type of bond, and sintering temperature to produce material of controlled porosity. This may, for some applications, be highly desirable, as in the case of oil-less bearings, where the pores act as oil capillaries, or as minute oil reservoirs.

Highly porous articles can be made successfully by bonding the powder with some foam-producing agent, which is destroyed by the heat of sintering, leaving a metallic "foam" behind; such material may be useful for filters, storage battery plates, and other purposes.

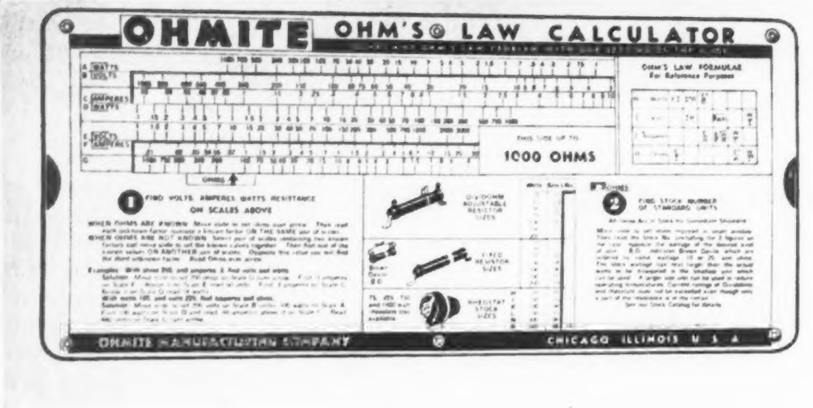
The dimensions of sintered articles can be held to close tolerances, since the dies for forming the powder compress can be accurately made, and by careful control, the volume changes on sintering can be closely regulated. These already close dimensions can be further improved by repressing and coining, so that the finished article is extremely accurate.

Although the first cost of the metallic powder is generally high, there is practically no loss of material during the manufacturing cycle, since the powder is accurately controlled by hopper feeds. With such an economy in the production cycle, the higher first cost may be compensated for, and the dimensional accuracy made even more attractive.

There are two general methods of powder metallurgy in use. These are: (a) Pressing of the powder at room temperature, followed by sintering in a suitable atmosphere at a temperature which is, in general, about two-thirds of the melting point of the alloy. (b) Pressing of the powder at such a high temperature that sintering takes place at the same time as the pressing.

The first is the more common method, since with the second, high pressures may have to be applied to hot metal powders in a controlled, non-oxidizing atmosphere, and this involves complicated equipment.

To obtain additional information on equipment described on this page, see lower part of page 160.



Calculator for Solving Ohm's Law Problems

Ohm's Law Calculator

A unique and convenient Ohm's law calculator has been designed for distribution to engineers, laboratory men, production managers, maintenance men, etc., by the Ohmite Mfg. Co., 4835 Flournoy St., Chicago, Ill. It gives the answer to any Ohm's law problem immediately, with but one setting of a slide. All values are direct-reading, and knowledge of the operation of an ordinary slide-rule is not required.

The calculator has scales on both sides covering the range of currents, resistances, wattages, and voltages commonly used in the industrial, electronic, and radio fields. Thus it covers the current and wattage range for motors, generators, lamps, and electrical apparatus up to 100 amperes or 1000 watts, and also the low current for high-resistance radio, sound, and electronic applications.

Multiplication, division, and the finding of squares and square roots can also be performed by the use of this calculator.

* * *

Gear Production Continues to Increase

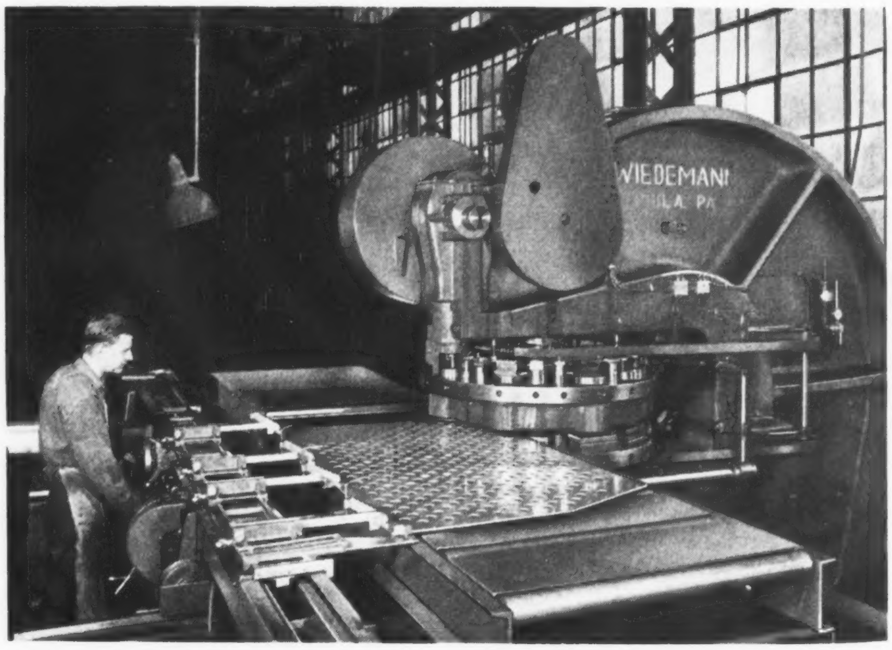
The American Gear Manufacturers Association reports that industrial gear sales for December, 1940, were 20 per cent above those for November, and 87 per cent above those for December, 1939. Industrial gear sales during the entire year of 1940 were approximately 50 per cent above the sales in 1939.

Arc Welding in the Production Industries

In a review of present trends in arc welding, W. W. Reddie, of the Westinghouse Electric & Mfg. Co., mentions that there is an increasing trend toward the use of small alternating-current transformer type welders for production work. Electrodes have been developed for practically all classes of welding with these units. The small alternating-current welders have also been extensively applied in operator training schools. The older school of thought was that beginners should be broken in on bare electrode. That was, and is, sound and logical practice for numerous reasons. However, in the present emergency, when men must be trained quickly, it is not sacrificing too much to start with coated electrodes, provided instructors sufficiently emphasize the basic principles that are considered to be best taught with bare electrodes.

* * *

Of every dollar spent by the driver of a car for gasoline, 25 cents represents taxes that have already been paid by the manufacturers and distributors of the gasoline. These taxes are in addition to the federal and state gasoline taxes paid directly by the car owner at the time of the retail sale. In other words, about one-half of the price paid for gasoline is *tax*.



General View of the Huge Wiedemann Turret Type Punching Machine Used at the Rock Island Arsenal for Punching Twenty-four Sizes of Holes in Platform Plates and Outriggers of Anti-aircraft Guns

NEWS OF THE INDUSTRY

Walter N. Larke, New General Superintendent of the Buick Motor Division

Georgia and Alabama

GEORGE B. KUTZ was recently appointed district sales manager for the southeastern territory of the Wright Manufacturing Division of the American Chain & Cable Co., Inc., York, Pa., manufacturer of hoists, cranes, and trolleys. His headquarters will be in Atlanta, Ga.

H. L. CHARLTON, vice-president of the Reynolds Metals Co., Richmond, Va., will be in charge of erection and purchases at the aluminum plant of the company, now under construction at Sheffield, Ala. BASIL HORSFIELD will be manager of the new plant.

Illinois

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., announces that while the company's carbide tools and blanks heretofore have been sold and serviced through the various district offices of the Vanadium-Alloys Steel Co. and a number of authorized agents, this service is now being extended by the organization of a direct engineering force under the management of the Vascoloy-Ramet Corporation. Factory branches have been established in Detroit, Cleveland, Cincinnati, Pittsburgh, Providence, Hartford, Jersey City, Philadelphia, and Milwaukee. Each office is managed by a trained sales engineer experienced in the application of carbide tools.

R. G. HASKINS Co., manufacturer of air-controlled tapping machines and flexible-shaft equipment, is building an addition to its factory at 615 S. California Ave., Chicago, Ill. The new unit will provide approximately 8000 square feet of additional manufacturing space.

HARRY J. SCHULTZ has been appointed central regional manager of the Construction Equipment Division of the Worthington Pump and Machinery Corporation, Harrison, N. J., with headquarters at 400 W. Madison St., Chicago, Ill.

LEONARD S. PARKER, who for several years has been superintendent of production for Skilsaw, Inc., Chicago, Ill., manufacturer of portable electric tools, has been made vice-president in charge of operations.

Michigan

BUICK AIRCRAFT DIVISION OF THE GENERAL MOTORS CORPORATION, Flint, Mich., has been formed as a separate Buick organization for the production of aircraft engines. J. G. HAMMOND has been appointed general manufacturing manager of the new division. Mr. Hammond was formerly general superintendent of the Buick Motor Division and has had many years experience in production engineering. R. H. ARCHER, formerly chief of standards, will be general superintendent of the Aircraft Division. Other changes in the Buick organization resulting from the formation of the Aircraft Division include the appointment of WALTER N. LARKE as general superintendent of the Buick Motor Division Mr. Larke was formerly assistant general superintendent. BYRON H. NEWELL, formerly superintendent of the Buick foundry, becomes assistant general superintendent.

WELLS MFG. CORPORATION, Three Rivers, Mich., manufacturer of metal-cutting band saws, has moved into a new foundry on a ten-acre tract of land east of Three Rivers. The need for the new plant was occasioned by the continuing growth of the company and the addition of a new saw to the Wells line, as well as to meet the present-day demand for quick delivery. The new factory is of modern, one-story design and covers approximately 20,000 square feet.

D. A. WALLACE, president of the Chrysler Division of the Chrysler Cor-

J. G. Hammond, General Manufacturing Manager of Buick Aircraft Division of General Motors

R. H. Archer, General Superintendent of the New Buick Aircraft Division

Byron H. Newell, Assistant General Superintendent of the Buick Motor Division

PROFITABLE MILLING EQUIPMENT –

No 000 . . . the machine for small parts milling on a variety of materials

• **Glance at these high production features —**

Automatic milling cycle — High rate of fast travel — Accurate reversal of table—Quick, accurate set-up — Wide speed and feed ranges

• ***Then*** **— investigate its production possibilities on your work - -**

Ask for full information on the No. 000 Plain Milling Machine — a profitable producer that has established an enviable performance in the rapid production milling of small pieces. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

BROWN &

poration, Detroit, Mich., and originator of the Superfinishing process, has been appointed by the American Society of Tool Engineers representative of that organization on the committee dealing with the classification and designation of surface qualities of the American Standards Association.

E. S. Chapman, who has been vice-president and assistant general manager of the Chrysler Corporation's Plymouth plant at Detroit, Mich., for the last five years, has been loaned by the corporation, at the request of the National Defense Commission, to serve on the staff of the Commission. Mr. Chapman will make his headquarters with the National Defense Commission and will devote his

E. S. Chapman, of the Chrysler Corporation, Who Will Serve on National Defense Commission

efforts to assisting it in organizing and directing the activities of the machinery industry in connection with the National Defense Program. Mr. Chapman's experience makes him well qualified for this important position.

Gairing Tool Co. has recently moved to larger quarters at 21221 Hoover Road, Detroit, Mich.

New England

F. W. McIntyre, vice-president and general manager of the Reed-Prentice Corporation, Worcester, Mass., is now located in Washington, where he is working with Howard W. Dunbar, vice-president of the Norton Co., Worcester, Mass., in the interest of the Council of National Defense. Mr. McIntyre's activities will be in connection with the Machine Tool Coordinating Committee, directed by Mason Britton, vice-chairman of the McGraw-Hill Publishing Co.

Ray H. Morris, Vice-president of Hardinge Brothers, Inc.

Ray H. Morris, who has been connected with Hardinge Brothers, Inc., Elmira, N. Y., for the last eight years, has been elected vice-president of the company, and will be in charge of the Hartford branch at 7 S. Main St., West Hartford, Conn. Previous to becoming connected with Hardinge Brothers, he was a sales engineer with the Davenport Machine Tool Co., of Rochester. He has had wide experience in the mechanical field, both in the sales and administrative branches.

Reed-Prentice Corporation, Worcester, Mass., has contracted for plant expansion of building and machinery to the amount of $400,000, in order to double its capacity to produce engine and toolroom lathes for the National Defense Program.

New Jersey

Rudolph F. Gagg, formerly assistant chief engineer of the Wright Aeronautical Corporation, Paterson, N. J., construction supervisor for that organization's expansion program, and more recently in charge of the construction of the aeronautical engine laboratory for the United States Government at Cleveland, Ohio, has been appointed assistant to the general manager of the Wright Aeronautical Corporation. Mr. Gagg joined the corporation as an experimental engineer in 1930, and was soon promoted to the position of assistant chief engineer.

Harold M. Malm has been appointed factory sales engineer for the Callite Tungsten Corporation, 544 Thirty-ninth St., Union City, N. J. Mr. Malm was originally a metallurgist with the company, but previous to his present appointment had served some time as design engineer and metallurgist for the Lee Spring Co. of New York.

New York

Stanley I. Vaughn, formerly manager of the experimental shop of the Curtiss Aeroplane Division of the Curtiss-Wright Corporation at Buffalo, N. Y., has been appointed factory manager of that organization's new 1,200,000-square foot factory now being constructed at Columbus, Ohio. Mr. Vaughn has been employed by the Curtiss organization almost continuously since 1915.

Robert L. Lerch has been appointed general sales manager of the Haynes Stellite Co., Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City. Mr. Lerch joined the Haynes Stellite Co. in 1924 as sales engineer, and has served as district sales manager at

Robert L. Lerch, New General Sales Manager of the Haynes Stellite Co.

Los Angeles and at Houston. Since 1929, he has been advertising manager and assistant to the general sales manager.

F. G. Sefing, metallurgist with the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York City, recently presented a paper entitled "Modern Cast Irons" before the York, Pa., chapter of the American Society for Metals, in which he discussed machine parts making use of properties available in modern cast irons.

Doehler Die Casting Co., 386 Fourth Ave., New York City, announces that, in response to the increased demands for its products for National Defense, it will build additions immediately to its Pottstown, Pa., and Batavia, N. Y., plants, to increase its facilities for the manufacture of die-castings in zinc, aluminum, brass, and magnesium alloys.

Orville T. Barnett has joined the welding electrode department of the

Corrugating and Curving

— metal sheets and plate are quick and simple on Cincinnati All-Steel Press Brakes. Cincinnati accuracy assures uniformity of pitch and radius . . . and easy assembly.

Write for Recommendations on Your Job

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

Metal & Thermit Corporation, New York City, in the capacity of engineer of tests. He was previously associated with Black, Sivalls, & Bryson, Inc., of Oklahoma City, where he first did research and welding control work, and was later in charge of shop inspection.

COSA OVERSEA TRADING CORPORATION, Chrysler Building, New York City, has been appointed exclusive agent for the distribution of the Maag gear-cutting and gear-grinding machines and all special controlling and checking devices manufactured by the Maag Gear-Wheel Co., Ltd., Zurich, Switzerland. The SWISS-AMERICAN GEAR MANUFACTURING CORPORATION, of the same address, is an affiliate of the Cosa Oversea Trading Corporation. The factory, which is at 110-114 Hoboken Ave., Jersey City, N. J., serves as a demonstration and show room for the machines. The shop is also cutting and grinding spur and helical gears in job lots. Any system of gear forms with any pressure angle can be supplied, and interchangeable gears can be cut without matching or lapping. JULIUS MUELLER is chairman of the board of directors, and E. T. LAUBSCHER is president of both companies.

Ohio

RAHN-LARMON CO., 2941 Spring Grove Ave., Cincinnati, Ohio, manufacturer of lathes, announces that the firm name has been changed to the NEBEL MACHINE TOOL CO. There will be no change in the present directors and officers of the company, F. T. Nebel continuing to hold the position of president and treasurer, and C. K. Nebel, that of vice-president. It is planned to erect a large new plant which will be located at Parkway and Sassafras St., Cincinnati.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces that January production was 50 per cent greater than in January, 1940. Production will be increased still more as the year progresses. The production of Monarch lathes in 1940 was close to two and one-half times the 1939 output. The company employs about 1000 people today, compared with 650 a year ago.

WARNER & SWASEY CO., Cleveland, Ohio, has rented the former Mid-town Motors Building on Prospect Ave., Cleveland, for the assembly of turret lathes for the British Government. The building is a one-story structure having a floor space of 43,000 square feet.

GEORGE A. BRYANT, executive vice-president and general manager since 1930 of the Austin Co., Cleveland, Ohio, engineers and builders, has been elected president and general manager of the company, succeeding the late W. J. Austin. Mr. Bryant first became associated with the Austin Co. as a field engineer twenty-seven years ago.

Pennsylvania

M. K. PECK, who has been representing William Sellers & Co., Inc., in the Cleveland territory, has been recalled to the home office of the company at Philadelphia to aid in production problems connected with orders for the National Defense Program. Mr. Peck received his training in the Sellers offices before taking over the Cleveland territory, to which he will return at the end of this emergency work.

G. DONALD SPACKMAN has been appointed general manager of the Lukens Steel Co., Coatesville, Pa., and its subsidiaries. Mr. Spackman joined the Lukens Steel Co. in 1919, and in 1929 was appointed assistant general superintendent. When the Lukenweld Division was formed in 1930 for the design and fabrication of welded steel structures for machinery and equipment service, Mr. Spackman was elected president of the division. In 1936 he was appointed general superintendent of the Lukens Steel Co.

G. Donald Spackman, Recently Appointed General Manager of the Lukens Steel Co.

LOUIS R. BOTSAI has been appointed manager of the gearing department at the East Pittsburgh Division of the Westinghouse Electric & Mfg. Co. For the last three years Mr. Botsai has been sales manager of the company's Small Motor Division in Lima, Ohio. For eight years previous to that, he was sales manager of gearing apparatus at the Westinghouse Nuttall Works in Pittsburgh. He joined the Westinghouse organization as a student engineer in 1915, and in five years attained the position of general manager of steel mill electrification at East Pittsburgh.

S K F INDUSTRIES, INC., Philadelphia, Pa., manufacturers of ball and roller bearings, are erecting an addition of 56,200 square feet of manufacturing floor space to their plant No. 2, on the Pennsylvania Railroad at Bridge Street. This building is of fireproof, sawtooth construction, conforming to the design of the main building. In addition, a two-story brick wing enclosing 12,000 square feet extends the office facilities at plant No. 1, Front Street and Erie Ave., bringing the total enclosed area of both plants to 666,600 square feet.

GEOMETRIC TOOL CO., New Haven, Conn., manufacturer of machinery and tools for cutting screw threads, announces that the company's products in western Pennsylvania, southeastern Ohio, and northwestern West Virginia are now being handled by the PENN GENERAL SUPPLY CO., 101-103 Market St., Pittsburgh, Pa., who will carry Geometric tools in stock in order to give customers in that area prompt service.

GEORGE W. FRICK, for nine years manager of the Ohio district of the Firth-Sterling Steel Co., McKeesport, Pa., has been made manager of the Firthite Division of the company, and will be in charge of sales of sintered-carbide cutting materials. HENRY P. JEAGER succeeds Mr. Frick as manager of the Ohio district.

Washington

M. C. BELLAMY, sales engineer of the Seattle office of the Timken Roller Bearing Co., Canton, Ohio, since 1934, has been made district manager of industrial bearing and steel sales for the Seattle territory. Mr. Bellamy is a graduate of Purdue University. He joined the Timken organization in 1928.

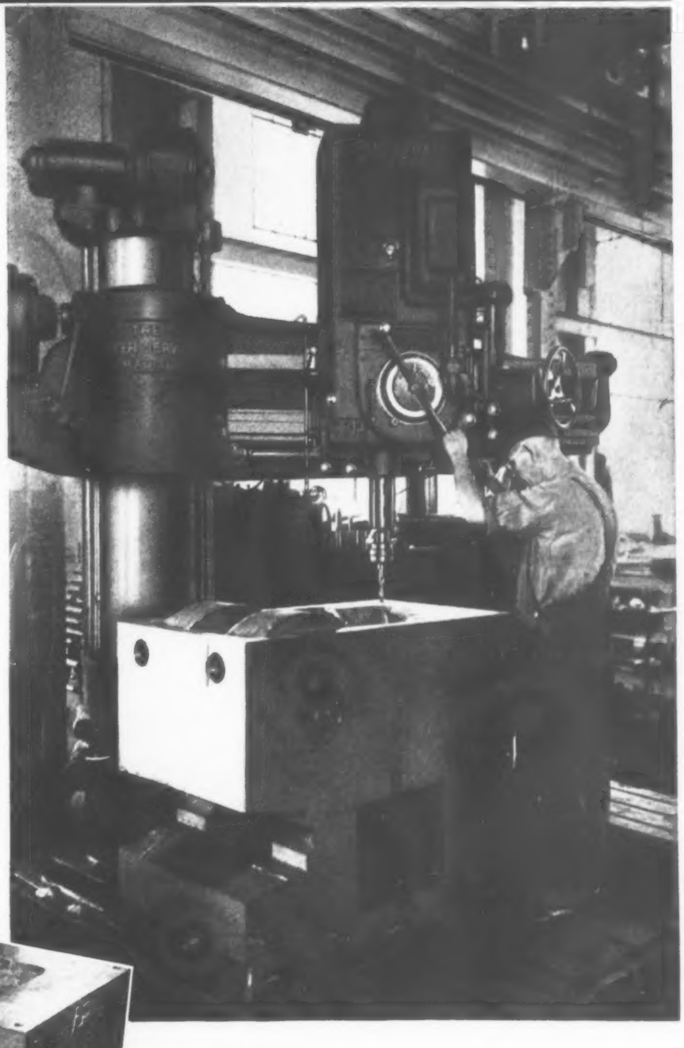
Wisconsin

GISHOLT MACHINE CO., Madison, Wis., announces that it has reopened its Northern Works, also located in Madison, in order to meet the current demands of the Defense Program for turret lathes. This expansion adds 60,000 square feet to the present manufacturing facilities. It is planned that operations will start in this plant by May 1, and production will be fully under way by the middle of the year. The new expansion in manufacturing facilities supplements several extensive additions to the production capacity of the company made in the past year. These previous increases in production capacity have all been within the main plant, and were effected by the replacement of old machine tools with new.

HAROLD F. FALK has been appointed general superintendent of the Falk Corporation, Milwaukee, Wis., manufacturer

Throughout Industry...

THIS TRADEMARK MEANS "MORE HOLES PER DOLLAR"!



"HANDLES WITH MINIMUM EFFORT"

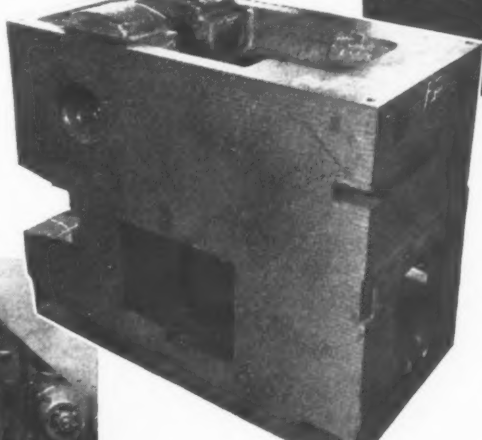
says Waterbury Farrel Foundry & Machine Co.

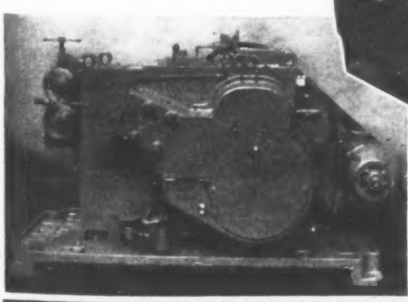
Operating convenience is an especially important feature in Radial Drill operation when the work is as large as the part illustrated.

Speed and feed, column and arm clamping, hand and power traverse, and elevation are all controlled at the head within easy reach of the operator of this Cincinnati Bickford Super Service Radial Drill.

The wide choice of feeds and speeds, positive safety measures for tools, machine and operator, are some of the reasons why this drill is well suited to the work of Waterbury Farrel and they say, "Performance entirely satisfactory."

For complete details, sizes and specifications write for Bulletin R-24.





OPERATION DATA

Part: Cast iron frame for Solid Die Double Stroke "Hi-Pro" Header, 46"x25'x38".

Operations: Drill and tap 4 corner holes 7/8" diam., 2 3/4" deep and 4 crankshaft bearing holes 5/8" diam., 1 1/2" deep.

Total time—floor to floor: 1 1/2 hours.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

of gears, couplings, steel castings, and heavy machinery. Upon receiving his degree from the School of Engineering at the University of Wisconsin, Mr. Falk became associated with the Falk Corporation and rose to the position of superintendent of the welding department, where he remained until 1936. After devoting his attention to time study and special work in the shop and engineering departments, he was placed in charge of shop production and schedules in 1937, working in that capacity until 1940, when he was appointed production manager.

SQUARE D Co. announces that its Milwaukee offices and all production of the Industrial Controller Division have been moved to a new 125,000 square foot plant on N. Richards St. at Capitol Drive, Milwaukee, where production capacity for machine tool control equipment has been increased 50 per cent. The new plant is a single-story structure, laid out for straight-line production. The design is such as to provide for future expansion when necessary. Abundant daylight is provided, and the offices are air-conditioned. The plant was erected by the Austin Co. of Cleveland, Ohio.

* * *

COMING EVENTS

MARCH 25-29 — MACHINE AND TOOL PROGRESS EXHIBITION, under the sponsorship of the American Society of Tool Engineers, to be held in Convention Hall, Detroit, Mich. For further information, address Ford R. Lamb, executive secretary, 2567 W. Grand Blvd., Detroit, Mich.

APRIL 1-3 — Spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Atlanta, Ga. C. E. Davies, secretary, 29 W. 39th St., New York.

MAY 5-7—Twenty-fifth annual convention of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Homestead, Hot Springs, Va. J. C. McQuiston, secretary, 602 Shields Bldg., Wilkinsburg, Pa.

MAY 12-15—Annual convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at the Hotel Pennsylvania, New York City. C. E. Hoyt, executive secretary, 222 W. Adams St., Chicago, Ill.

MAY 19-23—WESTERN METAL CONGRESS AND EXPOSITION to be held in Los Angeles, Calif., under the auspices of the American Society for Metals. The Congress will have headquarters at the Biltmore Hotel, and the Exposition will be held in the Pan American Auditorium. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland, Ohio.

JUNE 16-20 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Kansas City, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 12-15 — Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Louisville, Ky. C. E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 20-24—Twenty-third NATIONAL METAL CONGRESS AND EXPOSITION to be held in Convention Hall and Commercial Museum, Philadelphia, Pa. W. H. Eisenman, secretary, American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio.

Eye Protection—an Important Safety Feature in Industrial Plants

Two suggestions to help inaugurate a successful eye protection program in an industrial plant have been made by T. A. Walsh of the American Optical Co.'s Safety Division. The first step in starting such a program is to keep adequate and accurate records of eye accidents. These records should include costs of medical attention, compensation for lost time, loss in production spoilage, and other information having a bearing on the accident.

Second, a report should be made to the management in terms of dollars and cents and not in man-hours. If a report is submitted stating that $200 was lost in the department because of eye injuries, and that only $100 is needed to equip everybody in the department with safety goggles to prevent a recurrence of similar accidents, the advantage of providing such equipment is obvious.

A specific case may be of interest. In 1929, a company in the metal-working industry employing 41,500 people had a bill for eye accidents in that year of $51,000. The safety director presented that figure to the management and received its support in the inauguration of an eye protection program. In 1936, when the company employed 43,500 people, the bill for eye injuries was only $5800. About $30,000 had been invested in eye protection equipment; yet it paid for itself in a single year, and resulted in a net saving of $15,000.

Aluminum Industry Plans to Double Production

According to I. W. Wilson, vice-president in charge of operations of the Aluminum Co. of America, Pittsburgh, Pa., this company has decided to carry out immediately, at a cost of more than $150,000,000, a program of expansion that would normally take place during the next twenty years. The aluminum ingot production in 1939 amounted to 327,000,000 pounds. By July, 1942, this will have increased to 700,000,000 pounds annually. Thus, the industry will more than double the 1939 production in three years.

The National Defense Advisory Commission has stated that this increase in production takes care of all estimated defense needs, present and planned. Of equal interest is the fact that the Aluminum Co. of America has continued its policy of price reductions at a time when the price trends in most other commodities are upward. Aluminum ingot prices, which were 20 cents a pound at the beginning of 1940, had been reduced to 17 cents a pound by the end of the year.

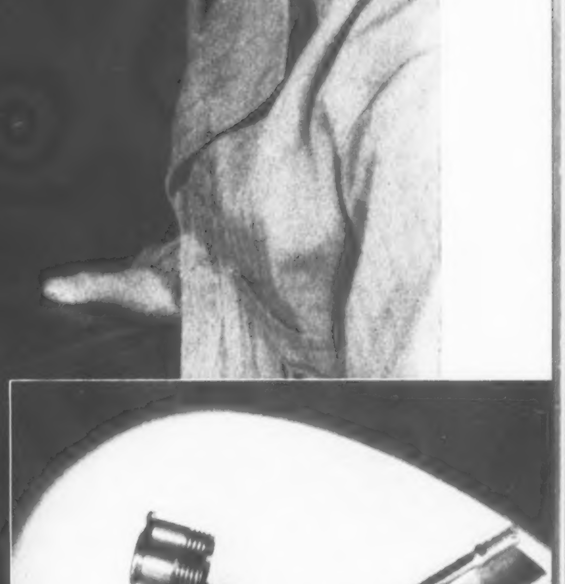
Production of aluminum reached an all-time high in 1940, and at the same time, the expansion plans for further increased production were speeded forward. The company itself is financing the more than $150,000,000 investment called for by its expansion program.

Of considerable interest is the fact that conditions that will arise at the end of the present emergency are given consideration right now. To keep men and plants at work after the present emergency demands have been met will present a serious problem. Therefore, the company has started to develop new peacetime uses and is planning wider peacetime markets for aluminum, intensifying the research related to such uses and broadening the field for the application of aluminum. The research program during 1940 has covered such important developments as the successful brazing of aluminum alloy products; the application of anodic treatment finishing processes for aluminum; improvements in aluminum house paint; and increasing applications of aluminum in marine service.

* * *

Government Needs Draftsmen

Engineering draftsmen in various fields are urgently needed by the United States Government. The salaries range from $1620 to $2600 a year. The branches in which draftsmen are now required are: Architecture; civil, electrical, heating and ventilating, mechanical, and structural engineering; and lithography, plumbing, radio, and topography. Further information and application forms can be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office; and from the U. S. Civil Service Commission, Washington, D. C.



To right: Typical of thousands of threaded parts being precision ground today by American industry on standard Ex-Cell-O Precision Thread Grinding Machines.

WITH MODEST INVESTMENT YOU CAN HANDLE *Precision Thread Grinding* . . . THE MODERN METHOD NOW DEMANDED BY INDUSTRY

PRECISION thread grinding has already become a vital step in the accelerated production of accurate threaded parts by American industry. Many manufacturers of parts for defense material—and for other products—are grinding threads with Ex-Cell-O Precision Thread Grinders after the threaded parts are hardened, or grinding threads from the solid after heat treatment, because only by this method can they obtain uniformly a high standard of accuracy in thread form, size, and finish. . . . With an Ex-Cell-O Precision Thread Grinder, *your* shop can produce accurately ground threads on a profitable production basis. You can not only take advantage of today's great demand for precision threaded parts, but also provide for the future, when the precision grinding of all threaded parts in which accuracy is essential will undoubtedly be required.

EX-CELL-O CORPORATION • 1212 OAKMAN BLVD. • DETROIT, MICH.

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1212 Oakman Blvd., Detroit, Mich.
Mail literature on Precision Thread Grinding.

Name ____________________
Firm ____________________
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EX-CELL-O XLO *Precision* MACHINES AND TOOLS

OBITUARIES

Fred R. Davis

Fred R. Davis, advertising space buyer for the General Electric Co., Schenectady, N. Y., for thirty-five years, died December 26 at his home in Schenectady after an illness of about two years. He was sixty-four years old. For many years, he supervised the expenditure of more than a million dollars annually for newspaper and magazine space.

Mr. Davis was born in Adams, Mass., and attended Union College in Schenectady. He graduated from the Worcester Polytechnic Institute in 1900 with the degrees of Bachelor of Science and Master of Science in Engineering. In 1901, he entered the General Electric organization as a test student, and in 1902 he went to Fort Wayne, Ind., as publicity manager for the Fort Wayne Electric Co. In 1905 he joined the General Electric's advertising department in Schenectady.

Mr. Davis was one of the founders of the Audit Bureau of Circulations in 1914. He served as a director of the Bureau from that date until his death, and since 1927 he was also first vice-president of the organization.

David Milne

David Milne, machine shop superintendent of the Farrel-Birmingham Co., Inc., Ansonia, Conn., for the last twenty-one years, died at his home in Milford, Conn., following a heart attack, on December 25. Mr. Milne had not been in good health for some time, but had been able to attend to his duties up to the day before he died.

Mr. Milne was born in Montrose, Scotland, September 30, 1878. He served his machinist apprenticeship at the Chapel Works in Montrose, and in 1900, went to Canada where he worked as a machinist in a railroad locomotive plant. From there he came to the United States, and in 1907 started work with the Farrel Foundry & Machine Co. as a vertical boring mill operator. Mr. Milne was not only an excellent mechanic, but also developed exceptional ability as a leader of men. In 1916, he was made a foreman, and in 1920, became superintendent of the machine shop.

He was especially well informed in the use of machine tools and his wide experience and knowledge enabled him to assist many machine tool builders in improving their designs.

Mr. Milne had a very fine philosophy of life and was extremely helpful to many individuals as a personal counsellor. He was particularly interested in young men and the Farrel-Birmingham apprentice training plan received his enthusiastic support. He was always present at all apprentice affairs and made many inspirational talks to the apprentice classes.

He is survived by his wife, two daughters, and a son.

Alfred C. Getz

Alfred C. Getz, vice-president and founder of the Sidney Machine Tool Co., Sidney, Ohio, died at his home in Sidney on January 9. Mr. Getz founded the Sidney Machine Tool Co. in 1904, and acted in the capacity of secretary and general manager until 1937, when he retired from active service. In 1909, he was instrumental in bringing to Sidney the A. P. Wagner Co. from Detroit, Mich., which was the beginning of the Monarch Machine Tool Co. He managed this company in its earlier days, in addition to directing the operation of the Sidney Machine Tool Co.

Alfred C. Getz

Susan Gammons

Susan Gammons, president and treasurer of the Gammons-Holman Co., Manchester, Conn., died at her home in Manchester on December 12. Mrs. Gammons was the widow of William Booth Gammons, inventor and founder of the company, and had held the position of president since the death of Mr. Gammons in 1932.

When Mr. Gammons began the manufacture of tools in 1918, Mrs. Gammons was active in assisting her husband in the foundation of the company, and was therefore experienced in the field of small tool manufacture when she took over the active management.

Mrs. Gammons is survived by one daughter, Marion G. Fitch, who is general manager of the company and succeeds Mrs. Gammons as president.

* * *

Navy Ordnance Plants to be Operated by Westinghouse

Two new navy ordnance plants—one at Louisville, Ky., and one at Canton, Ohio—are being erected to be operated by the Westinghouse Electric & Mfg. Co. When completed, the $5,000,000 Louisville plant, employing 1000 skilled workers, will operate principally as an assembly unit, receiving parts from other ordnance plants and manufacturers. James K. Weaver, formerly director of equipment, inspection, and test, will be manager of the Louisville plant. He will be succeeded in his former position by Edward D. Gangwere.

The $16,000,000 Canton plant will employ about 2000 people. R. V. Gavert will serve as manager of this plant. He was previously superintendent and manager of manufacturing of the Westinghouse Sharon plant. Orders for $6,250,000 worth of machine tools for the two plants have been placed, and in the next few months there will be additional orders amounting to five or six million dollars.

* * *

Metallurgists Needed for National Defense Work

The United States Civil Service Commission, Washington, D. C., announces that it is receiving applications for positions of metallurgists and metallurgical engineers of various grades, with salaries ranging from $3200 to $5600 a year. Qualified persons are urged to send their applications to the Commission. Further information and application forms can be obtained from the Secretary of the Board of U. S. Civil Service Examiners at any first- or second-class post office, or directly from the United States Civil Service Commission.

Addition of the center bearing on the spindle of Milwaukee Milling Machines reduces by one-half the distance between bearings and thus increases rigidity 8 times—(shaft deflection varies as the cube of the distance between bearings.)

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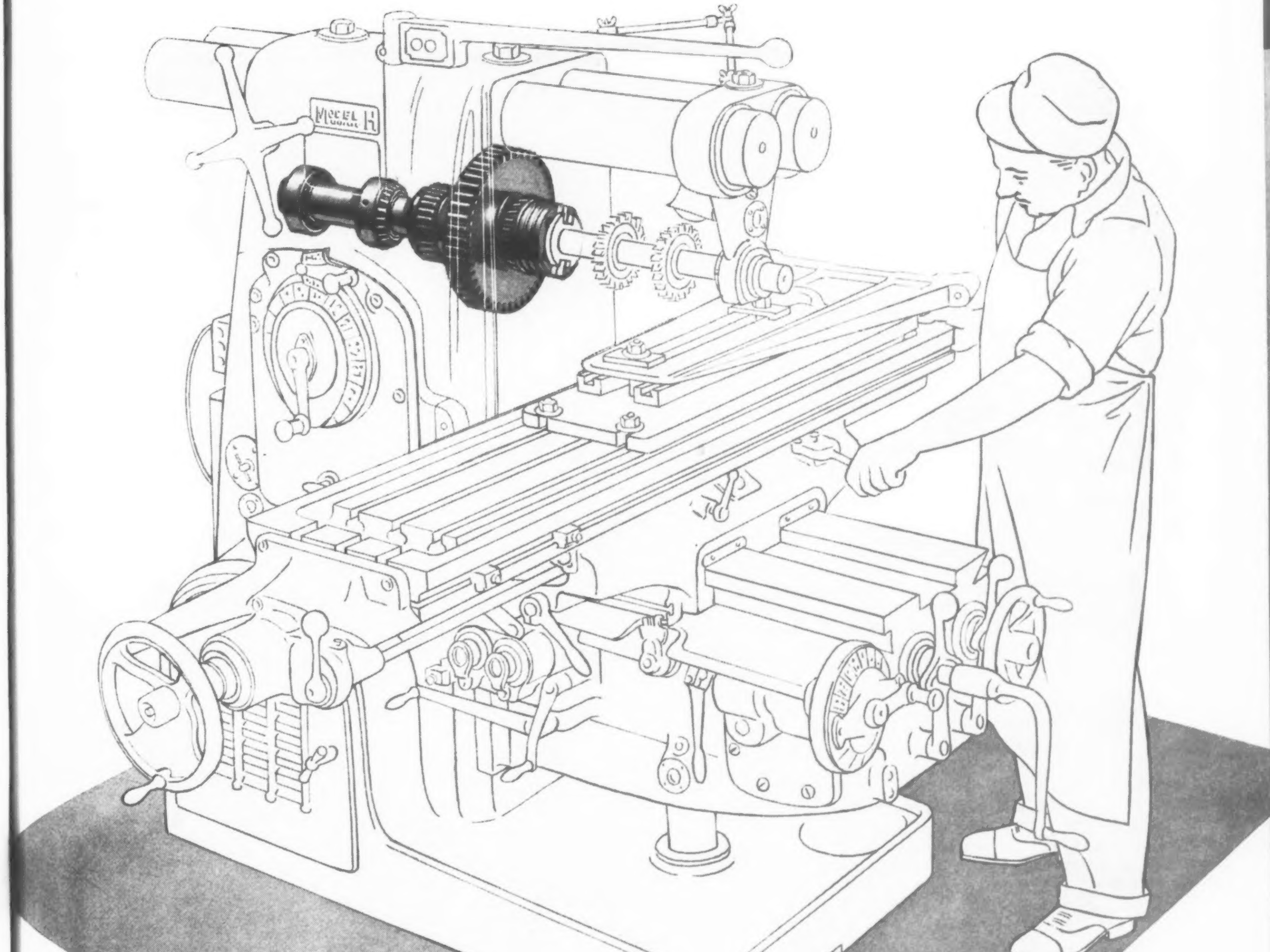

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NEW BOOKS AND PUBLICATIONS

Modern Plastics Catalogue (1941). 476 pages, 9 by 12 inches. Published by the Breskin Publishing Corporation, 122 E. 42nd St., New York City. Price, $3.50.

This comprehensive directory and catalogue covering the plastics industry has been brought out previously as a special annual number of the *Modern Plastics Magazine*. Owing to growth of the industry, this work has become so voluminous that it is now being issued as a separate publication. There are nine main divisions of the book. The first —Plastics Engineering — contains flow sheets showing at a glance the manufacturing procedure involved in producing various plastic materials.

The Materials Section consists of a series of articles covering all types of plastics — forms available, methods of fabrication, applications, properties, and trade names. All new developments and applications during the last year are included. Another division is devoted to molding and fabricating. Under the heading Machinery and Equipment, new developments in all types of molding presses, extruding machines, assembly devices, and molding plant equipment are covered. Other sections treat of laminates and plastic coatings.

One of the valuable features is a plastics properties chart, which has been completely revised and brought up to date. The book includes for the first time tables on solvents and plasticizers. The directory section contains a complete list of customs molders, as well as a list of foreign manufacturers of plastics in Canada, South America, and Mexico. It includes a list of technical, design, and vocational schools in the United States that give courses in plastics, and a selected bibliography of books and magazines on plastics. There is, in addition, a complete list of the names and addresses of those companies engaged in various phases of the plastics industry, as well as a directory of trade names.

Ingot Brass and Bronze. Loose-leaf publication, 8 1/2 by 11 inches in size. Published by the Non-Ferrous Ingot Metal Institute, 308 W. Washington St., Chicago, Ill. Price within continental United States, $5, net. Price to purchasers outside of continental United States, $5, net, American funds plus transportation costs.

This manual has been prepared for the purpose of assisting users of nonferrous foundry alloys to utilize quality copper-base alloys in ingot form with maximum economy and efficiency. The material presented is based on the information gathered by the Metallurgists' Advisory Committee of the Institute, which is composed of the chief metallurgists of all member companies. At the meetings of the committee, common problems are discussed and information exchanged on alloys and advanced procedures for the production and utilization of ingot brass and bronze. This technical information has been coordinated and brought together in the present manual. The material is published in loose-leaf form, so that new data can be added from time to time and revisions incorporated.

The first edition contains six chapters on the following subjects. Economy and Utility of Ingot Brass; Nomenclature and Classification; Physical Properties, Including Definitions of Terms Relating to Methods of Testing; Data on the Twenty-Three Standard Alloys of the Institute, Including Chemical Specifications, Physical Properties, Applications, etc.; Miscellaneous Specifications on Brass and Bronze Ingots and Castings in Current Use, with References as to Wear and at What Price Complete Copies of the Original Specifications can be Obtained; Foundry Practice and Foundry Defects, Listing the Nature of Twenty-Two Different Types of Defects and the Usual Causes of Them.

Mastering Momentum. A Discussion of Modern Transport Trends and Their Influence Upon the Equipment of American Railways. By Lewis K. Sillcox. 274 pages, 6 by 9 inches; 130 illustrations. Published by the Simmons-Boardman Publishing Corporation, New York City. Price, $2.50.

This book is based upon a series of lectures that the author presented at the Massachusetts Institute of Technology over a period of four years. The author, who is first vice-president of the New York Air Brake Co., and who has long been connected in various capacities with the railway transportation field, is well qualified to present this thorough study on present trends in transportation equipment and their effects.

The scope of the work can best be indicated by listing the chapter headings, as these give an indication of the topics covered. They are as follows: The Mechanics of Train Operation and Train Braking; Railway Car Wheels; Railway Car Axles; Locomotive and Car Truck Design—Rail Reactions and Riding Qualities; Draft Gear. Each of these subjects is given a very complete treatment. While the book is of a thoroughly practical character throughout, mathematical treatments have been freely used wherever necessary to bring out important points or relationships.

Industrial Management. By Richard H. Lansburgh and William R. Spriegel. 666 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $4.50.

This is the third edition of a work discussing the fundamental principles of sound industrial management. The text is intended primarily for the college student who has had little or no industrial experience, although the previous edition has been used successfully in teaching employed men and women in evening classes. It covers all the aspects of management, including product development and research; machines and equipment; personnel relations; wage payment; and managerial controls and operating procedures. The new edition emphasizes the social and personnel aspects of industrial organization and management, which have grown increasingly important in the last decade. A chapter has been included summarizing some of the governmental influences on management.

Engineering Drawing Problems. By Frederic G. Higbee and John M. Russ. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $2.25.

This book, published in a loose-leaf form, contains 114 problems in engineering drawing intended to be used in teaching this subject in connection with the usual textbook. These problems present the essential principles and conventions of drawing, and provide the student with training in drafting. The exercises consist of completing partially made drawings in accordance with instructions or making original drawings to illustrate the principles brought out. Blank sheets are included for the purpose, as well as a few sheets of tracing paper. At the beginning of each group of problems, a brief statement is made of the purpose of the problems. The instruction ranges from free-hand lettering to the making of complete working drawings.

Pressworking of Metals. By C. W. Hinman. 443 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $4.

This is a reference book illustrating and describing practical applications of the principles used in the design of punches and dies. It tells how to select and use presses, how to select materials or handle those specified, and how to design and construct dies. The text covers every type of press and shows principles of die problems upon which a variety of tool designs for specific problems may be based. The physical properties of metals for strip and sheets and other important information are included.